PROGRAM MANAGER
RMA CONTAMINATION CLEANUP

U.S. ARMY
MATERIEL COMMAND

— COMMITTED TO PROTECTION OF THE ENVIRONMENT —

Rocky Mountain Arsenal

Proposed Final
Rocky Mountain Arsenal
Chemical Index
Volume I

August, 1988

Prepared by:

Program Manager's Office for

Rocky Mountain Arsenal

Contamination Cleanup

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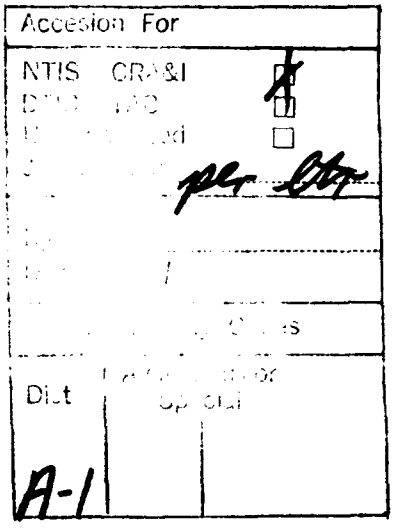
ROCKY MOUNTAIN ARSENAL

ROCKY MOUNTAIN ARSENAL

CHEMICAL INDEX

VOLUME I



August 1988

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EXECUTIVE SUMMARY

The Rocky Mountain Arsenal (RMA) Chemical Index is a three volume reference document for over 300 chemicals that have been associated with the historical operations (manufacturing and disposal) of the Army and lessees at RMA.

This document was developed as a basis for (1) the selection of target analytes for the Remedial Investigation (RI) and Endangerment Assessment (EA), (2) the evaluation of nontarget contaminants measured arsenal-wide in soil and ground water, and (3) the determination of potential chemical-specific Applicable or Relevant and Appropriate Requirements (ARARs) as required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), and the Superfund Amendments and Reauthorization Act (SARA) of 1986. In addition, the Index is intended to serve as a general source of information for compounds associated with RMA operations.

Volumes I and II contain the background and rationale for developing the Index together with the individual chemical information listed by chemical name in alphabetical order. Also included in these two volumes are four appendices consisting of a comparison of the 1986 version of the Index to the May 1988 document; comments by the Organizations and the State, and responses to the 1986 document; evaluation of

nontarget compounds detected in RMA soil and ground water; and comments by the Organizations and the State, and responses to the May 1988 Index.

Volume III presents the rationale for identifying potential ARARs for all chemicals listed in Volumes I and II, lists the ARARs by chemical in alphabetical order, and specifies whether the designated chemicals constitute CERCLA Hazardous Substances or are subject to monitoring by the Army. The development of ARARs in Volume III is intended for the On-Post Operable Unit. A similar volume will be issued for the Off-Post Operable Unit at a later date.

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ROCKY MOUNTAIN ARSENAL CHEMICAL INDEX

INTRODUCTION

1.1 Purpose of the Chemical Index

The Rocky Mountain Arsenal (RMA) Chemical Index has been developed to serve as a reference document to the RMA remedial investigation (RI) and endangerment assessment (EA). The chemicals listed in the Index have appeared in many references which have attributed them to activities of the Army or lessees at RMA. These chemicals are listed in Table 1. There are 320 chemicals included with information regarding their site-specific production, use, and disposal, and also information regarding the availability of previous monitoring results. In addition, data related to the compounds' environmental fate and transport, toxicity, and physical and chemical properties are included.

The Index also serves as a basis for the selection of target analytes for the RI, the exposure and risk evaluations under the EA, and the determination of potential, chemical-specific Applicable or Relevant and Appropriate Requirements (chemical-specific ARARs). The chemical-specific ARAR determination is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Superfund Amendments Reauthorization Act (SARA).

1.2 Development of the Chemical Index

The Chemical Index has evolved from an initial compilation of compound names related to RMA activities in September 1984. This list was the result of working meetings with technical experts having experience with RMA activities and monitoring data. The history of the revisions to the Chemical Index, between 1986 and May 1988, which led to the Draft Final, (May 1988) version is discussed in Appendix A. Comments to the 1986 version of the Index from the U.S. Environmental Protection Agency (USEPA), the Colorado Department of Health (CDH), and Shell Chemical Company (Shell) were received and considered in the preparation of this current version of the Index. These comments and their responses are provided in Appendix B.

A document similar to the Chemical Index has been prepared by Morrison-Knudsen Engineers, Inc. for Shell. The document, "Ranking of Chemicals, Compounds and Substances of Possible Significance at Rocky Mountain Arsenal" (December 1986), was reviewed but did not provide any additional information. In addition, a letter from Holme, Roberts & Owen to Donald Campbell of the Program Manager's Office for Rocky Mountain Arsenal dated January 15, 1987 was reviewed. It provided suggestions for nomenclature conventions for the

Index. The suggestions were considered for the standardization of the nomenclature system of the Draft Final version of the RMA Chemical Index.

A list of elements and compounds associated with operations on RMA was compiled by Geraghty & Miller, Inc. in September 1984. The list included agents manufactured by the Army, products manufactured by Julius Hyman Company and Shell Chemical Company, and associated raw materials. By-products and reaction intermediates were also included to the extent that they were included in Arsenal soil or ground-water monitoring programs, or were reported by the Army or lessees in their reports. The resulting list included over 300 entries.

Production of the chemical list prompted a response from counsel representing Shell. Edward J. McGrath of Holme, Roberts & Owen submitted an RMA chemical list on September 20, 1985 to the RMA Program Manager's Office for consideration for inclusion in a comprehensive chemical index. Preparation of a comprehensive chemical index was approved and a draft was published in April 1986. This index contained a comprehensive list of chemicals that were noted in Army and lessee reference sources or detected on-site. The 1986 Chemical Index included 666 entries.

1.3 Role of the Chemical Index in the RI/EA Process

By virtue of the large number of chemicals and substances which have been identified as being related to Arsenal activities, it was necessary to select a subset list of compounds to serve as target analytes for both the RI (which assesses potentially contaminated sites) and the EA (which evaluates potential risks to human health and the environment) programs. To accomplish this task, the larger, inclusive list of chemicals was screened and the target analytes were selected using the following criteria:

1. The substance was produced, disposed of, or handled in large quantities at RMA (This was a qualitative assessment and is no longer important for the RI target analyses);

2. The chemical is toxic;

3. The chemical is persistent in the environment;

4. The substance was an Army agent or degradation product of an agent likely to be present in the environment; and

5. The chemical is an analyte in monitoring or investigatory programs presently being carried out on or in the vicinity of RMA.

If a substance met criterion 1, 4, or 5 above, it was tentatively identified as a target analyte, and only removed from consideration if it did not meet either criterion 2 or 3. A broad interpretation was used for criteria 2 and 3. Specifically, any substance not obviously benign was interpreted as toxic, and chemicals were considered persistent if they maintained their integrity in the environment for more than a few days. The statement "not obviously benign" relates to the apparent toxicity of a chemical. For example an oral dose value greater than 5000 mg/kg would characterize the chemical as benign. The persistence assessments were based on relative degradation rates as opposed to referenced environmental half lives. In addition, persistence was interpreted with respect to environmental hydrolysis and biodegradation, rather than volatilization. Volatilization was not considered as a pathway of contaminant dissipation from soil or ground water.

In 1985, the list of target analytes related to Arsenal activities (both Army and lessees) was compiled using this methodology and contained 54 compounds. This list with subsequent revisions (both additions and deletions) due to the availability of new information, became the "Hit List" and

"Potential for Migration List" of the 1986 draft of the Index. During 1986 and 1987, 17 additional chemicals representing degradation products of Army agent materials were added to the target list of analytes. This list of elements and compounds, now numbering 88, is presented in Table 2. Of the 88 entries listed, 52 are target analytes for the ground-water monitoring program, 62 are soil target analytes, 10 are designated for the off-post ground-water endangerment assessment, and 61 are for the on-post soil endangerment assessment. Many of the analytes listed in Table 2 are target compounds for more than one investigatory program.

In order to be consistent with the process described in the Superfund Public Health Evaluation Manual, a chemical-specific ARAR must be considered for each of the target constituents as part of the baseline health evaluation. A discussion of the chemical-specific ARARs for compounds related to RMA activities is given in a document compiled by the U.S. Department of Justice (USDOJ). This report is a companion document to the RMA Chemical Index, and is provided as Volume III of this version of the Index.

1.4 Consideration of Nontarget Compounds for Inclusion in the Chemical Index

In addition to the target analytes of the RI, nontarget compounds (nontargets) were also identified using gas

chromatographic/mass spectrometric (GC/MS) methods which were used for the analysis of ground-water and soil samples collected as part of the RI. These methods allow for the comparison of sample response peaks (spectra) with the known spectra for the target compounds and with reference spectra stored in a computer library, and the subsequent tentative identification of nontarget compounds with these library matches. Under the Phase I RI Program, the identified nontargets were evaluated on a site-by-site basis to determine whether additional compounds warranted investigation under Phase II of the site's RI program.

The evaluation procedure for the nontargets was developed and applied to all nontargets identified on RMA. The procedure was used to determine whether additional compounds should be designated as potential target analytes for the EA. The approach to nontarget compound review, as conducted under the Phase I of the RI, and the current Arsenal-wide nontarget screening methodology for the EA are discussed in greater detail in Appendix C. The chemicals designated for inclusion on the target list for the EA as a result of the nontarget screening evaluations are listed in Table 3.

1.5 Overview of Chemical Index

Eleven categories of information are presented for each of the 320 chemicals included in this Chemical Index. The scope of information covered by each entry heading follows.

Primary name

This heading is the key to the entry. The nomenclature is standardized according to the system of the 9th Collective Index of Chemical Abstracts, as is presented in Sax (1984) and the Chemical Information Systems, Inc. (1987). The pesticides and herbicides are named according to the name specified in the Farm Chemicals Handbook (1986). Most often, the Chemical Abstract Service (CAS) name and the Farm Chemicals Handbook name are the same. If the compound were not included in either of these sources, the International Union of Pure and Applied Chemistry (IUPAC) nomenclature system was used.

Although the IUPAC represents the compilation of formal rules in chemistry, the CAS system was chosen because it is readily available and less cumbersome than the IUPAC system. Both nomenclature systems are very similar for acyclic, monocyclic, and fused polycyclic compounds. The CAS system has specific rules, whereas the IUPAC system offers a variety of choices for a specific rule. Also, the CAS system

lists chemicals by primary names which have directly associated CAS Registry Numbers (RNs). Use of the CAS name allows entry into other indexing systems, which is another reason the CAS system was selected.

Synonym

Since it is not reasonable to include all possible synonyms, this heading only presents some commonly used synonyms.

CAS RN

This heading is an abbreviation for the Chemical Abstract Service Registry Number which is unique to each compound. The CAS RN allows the Index user to more readily extract additional information about the compound's behavior and properties from other sources.

Formula

The chemical formula for the entry compound is given, if available. It is unavailable if the entry reflects a formulation, mixture, or trade name.

Information sources

This entry indicates which party or parties might provide additional information concerning the compound. The determination as to the information source(s) is based solely upon a judgment of the parties' familiarity with the technical data on a specific compound. This determination does not desigate any party as the singular expert on any compound.

History of use, production, disposal & quantities

This heading references the history section of the Phase I source - Specific Contamination Assessment Reports (CARs) for information regarding historical use, production, disposal and quantities, if available or the original reference used to obtain history data. The history section of the CARs was updated during 1987 and 1988 by Acumenics, Inc. (a contractor to the U.S. Department of Justice.) If no specific-RMA data were available, then the likely source of the compound is given (e.g. possibly related to Lewisite.)

Monitoring history

It was not possible to include the monitoring results for each entry compound; however, information regarding the

inclusion of the compound in a monitoring program and the name of the program is given.

Environmental fate

This heading presents a brief summary of the physical and chemical properties of the entry compound which influence its behavior in the environment. The properties are aqueous solubility, logarithm of the octanol/water partition coefficient (Kow), half lives and volatility. For some of the properties (e.g. Kow and solubility) additional numerical values are likely to be found in the open literature, given the differences which exist in experimental protocols and/or estimation procedures. Wide variations in conclusions can be drawn from these literature values, since the data interpretation depends heavily on the depositional history of the site, environmental factors, and site-specific conditions. Hence, it is highly recommended that independent research be conducted for these types of data before any values are accepted from the Index. The Index values are provided for guidance and are intended to serve as preliminary values to be further researched.

Additional information on environmental fate (i.e. persistence) and compound mobility are presented to the extent that these data are available. The persistence assessment was based on biological activity (i.e. the application of

the substance to active growing season); the persistence criteria are the following:

Low - affects current crop only (<60 days)

Moderate - residuals from application are present (60 to 365 days)

High - a potential for application carry-over to the next year occurs (>365 days)

Toxicity

The information contained within this heading is not intended to be all-inclusive nor is it interpreted. It includes a notation for known carcinogens or suspected carcinogens (Sax 1984; Federal Register 1986), and also a toxicity rating based on acute oral, dermal and inhalation data for experimental animals and/or acute toxicity data for humans, as available. In general, the Registry of Toxic Effects of Chemical Substances (RTECS, 1983-1984) served as the source for all toxicity data; however, other sources were also utilized and they are referenced as appropriate.

In all cases where data were available for more than one exposure route (i.e. oral, dermal, and inhalation), the datum which yielded the most conservative toxicity score was used. Therefore, the toxicity ratings presented for each chemcial may not reflect the actual toxicity for all exposure routes. The criteria for determining the toxicity

scores (49 Federal Register, pp. 37981-37982, Wednesday September 26, 1984) are presented below.

Toxicity Score	Oral LD_{50} (mg/kg)	Dermal LD_{50} (mg/kg)	Inhalation LC_{50} (ppm)
4	< 50	< 200	< 0.05
3	50 - 500	200 - 2,000	0.05 - 0.5
2	500 - 5,000	2,000 - 5,000	0.5 - 5
1	> 5,000	> 5,000	> 5

Toxicity scores 3 and 4 represent more highly acutely toxic chemicals, while scores 1 and 2 represent chemicals of moderate or low toxicity. These toxicity categories as set forth under Federal Insecticide, Fungicide and Rotenticide Act (FIFRA) are consistent with the toxicity categories specified in other federal statutes, including the Federal Hazardous Substances Act and the OSHA Hazard Communication Standard. As a matter of perspective, under FIFRA, a chemical with toxicity scores of 3 or 4 should not be available to the general public for domestic use.

The USEPA carcinogenic classifications, as described in the September 24, 1986 Federal Register, are described below.

- A - the compound is a known human carcinogen;
- B - the compound is a probable human carcinogen; (B1, probable human carcinogen-limited evidence in humans; B2, probable human carcinogen-sufficient evidence in animals and inadequate evidence in humans)

- C - the compound is a possible human carcinogen;
- D - the compound has not been classified; and
- E - there is evidence of non-carcinogenicity.

Included on target list(s)

This heading indicates whether the compound is considered a target analyte in the soil or ground-water investigations of the RI. Inclusion as a target analyte in either of the EA programs (on-post soil or off-post ground-water) is not indicated since, with few exceptions, the RI and EA soil and ground-water target analytes are identical.

References

The references listed are those used to compile the entry information, and may include references used for historical data previously included in the Draft Final version of the Chemical Index with chemical specific ARARs for On-Post Operable Unit.

1.6 References

Chemical Information Systems, Inc. 1987. Database searches for Chemical Abstract Service nomenclature system, carried out during 1987.

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Sax, N. I. 1984. Dangerous Properties of Industrial Materials. Van Nostrand Reinhold Company, New York, New York, 3,124 pp.

Shell Chemical Co. 1986. Letter to Mr. Donald L. Campbell, Office of the Program Manager - Rocky Mountain Arsenal Contamination Cleanup, Comments to Rocky Mountain Arsenal Chemical Index, Final Draft Report, April 1986; July 22, 1986.

US Environmental Protection Agency, Office of Emergency and Remedial Response. 1986. Superfund Public Health Evaluation Manual, EPA #540/1-86/060 October 1986.

US Environmental Protection Agency, Region VIII. 1986. Letter to Col. W.N. Quintrell, Deputy Program Manager, U.S. Army Toxic and Hazardous Materials Agency, Comments to Rocky Mountain Arsenal Chemical Index, Final Draft Report, April 1986; June 13, 1986.

U.S. Office of the Federal Register, 1984, September 26. Volume 49, Code of Federal Regulations, pp. 37981-37982.

US Office of the Federal Register, 1985, November 13. Vol. 50, Code of Federal Regulations, Part 219, pp. 46936-47022.

US Office of the Federal Register, 1986, September 24. Volume 51, Code of Federal Regulations, Part 185, Final Guidelines for Carcinogen Risk Assessment, pp. 33992-34003.

Table 1 Comprehensive List of Chemicals Included in the August 1988 RMA Chemical Index

Acetone
Acetonitrile
Acetylene tetrachloride
Adamsite
Adhesive VI and VIII
Aerozine 50
Akton
Aldrin
Allyl alcohol
Aluminum hydroxide
alpha-Amino-iso-butyronitrile
Ammonia
Ammonium chloride
Ammonium nitrate
Ammonium sulfate
Ammonium sulfite
Antimony
Antimony (III) chloride
Arsenic
Arsenic chloride
Arsenic trioxide
Atrazine
2H-Azepin-2-one,hexahydro
Azodrin

Barium
Benzene
Benzothiazole
Benzoyl peroxide
Bicyclo(2.2.1)hepta-2,5-diene
Bis-carboxymethyl sulfone
Bis-carboxymethyl sulfoxide
Bis(2-chlorovinyl)chloroarsine
2-[Bis(1-methylethyl)amino]-ethanethiol
Bisphenol A
Bladex
Bromic acid, potassium salt
Bromide
alpha-Bromoallyl alcohol
3-Bromo-1-chloro-1-propene
2-Butoxyethanol

Cadmium
Calcium
Calcium bromate
Calcium carbide

Table 1 Comprehensive List of Chemicals Included in the August 1988 RMA Chemical Index

Calcium chloride
Carbon tetrachloride
2(1'-Carboxyl-1'-methyl-ethyl-amino)-4,6-dichloro-s-triazine
Chloral hydrate
Chlorate ion
Chlordane
Chlorfenvinphos
Chloride
Chlorinated paraffin, Chlorcosane
Chlorinated phenol
Chloroacetaldoxime
Chloroacetic acid
Chloroacetoacetic acid
Chloroacetophenone
Chlorobenzene
4-Chlorobenzenethiol
Chlorobromopropane
4-Chloro-3,5-dinitrophenyl methyl sulfone
Chloroform
2-Chloroisophorone
2-Chloro-3-oxo-butanoic acid, methyl ester
p-Chlorophenyl methyl sulfide
p-Chlorophenyl methyl sulfone
p-Chlorophenyl methyl sulfoxide
2-Chlorovinylarsonic acid
Chromic acid
Chromium
Copper
Copper sulfate
Crotoxyphos
Cyanide
Cyanogen chloride
2(1'-Cyano-1'-methylethylamino)-4,6-dichloro-s-triazine
Cyclohexanone
2-Cyclohexen-1-one
1,3-Cyclopentadiene

D-D soil fumigant
DDE
DDT
DDVP
1,2-Dibromo-3-chloropropane
Dibromodichloroethene
1,1 Dibromoethane
2,6-Di-tert-butyl-p-cresol
2,2-Dichloroacetaldehyde
2,2-Dichloroacetoacetic acid

Table 1 Comprehensive List of Chemicals Included in the August 1988 RMA Chemical Index

p-Dichlorobenzene
2,2-Dichloro-1-(2,4-dichlorophenyl)-ethanone
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
1,2-Dichloroethylene
3,4-Dichloro-5-nitrophenyl methyl sulfone
1,2-Dichloropropane
cis-1,3-Dichloropropene
Dicrotophos
Dicyclopentadiene
Dieldrin
Diethyldimethyldiphosphonate
O,O-Diethylphosphorochloridothioate
O,O-Diethyl thionophosphonate
2,4-Dihydroxy-2-methyl pentane
S-Diisopropylaminoethyl-methylphosphonothioate
2-(Diisopropylamino)-n-ethyl sulfonate
Diisopropyldimethyl diphosphonate
N,N-Diisopropylethanolamine
Diisopropyl methyl phosphonate
Dimethanonaphthalene
N,N-Dimethylacetoacetamide
Dimethyl arsenic acid
Dimethylchloroacetoacetamide
N,N-Dimethyl-2,2-dichloroacetoacetamide
Dimethyldisulfide
1,1-Dimethylhydrazine
Dimethylmercury salts
Dimethyl methylphosphonate
Dimethylnitrosamine
Dimethyl phosphate
O,O-Dimethylphosphorochloridothioate
1,3-Dimethylurea
Dipiperazine
Dipropylamine
Di-n-propylnitrosamine
1,4-Dithiane

Endrin
Ethanamine
Ethyl benzene
Ethyl methyl phosphonate
O-Ethyl methyl phosphonothioate
Ethyl parathion

Table 1 Comprehensive List of Chemicals Included in the August 1988 RMA Chemical Index

Fenvalerate
Fluoride
Fluoroacetic acid
Fluoranthene
Formaldehyde
Freon 113
Fuel Oil #6

Gardona
Gear oil additive 399
Glyceryl mono-oleate
GOOP (Mg dust, oil/asphalt)

HCCPD impurities
Heptachlor
Heptachlor epoxide
Heptachlorobicycloheptene
Heptane
Hexachlorobenzene
1,2,3,4,7,7-Hexachlorobicyclo(2.2.1)hepta-2,5-diene
Hexachlorobutadiene
Hexachlorocyclopentadiene
4,5,6,7,8,8-Hexachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene
n-Hexane
Hexone
Hydrazine
Hydrobromic acid
Hydrochloric acid
Hydrofluoric acid
Hydrogen sulfide
alpha-Hydroxy-4-(1'-carboxyl-1'-methyl-ethylamino)-6-ethylamino-s-triazine
1-exo-Hydroxychlordene
4-Hydroxy-3,5-dinitrophenyl methyl sulfone
4-Hydroxy-4-methyl-2-pentanone
Hypochlorous acid, calcium salt

Impregnite CC2
Impregnite CC3
Iron (III) Oxide
Isobutylmethacrylate
Isodrin
Isopropyl methyl phosphonate

Table 1 Comprehensive List of Chemicals Included in the August 1988 RMA Chemical Index

Keto-endrin

Landrin
Lead
Lewisite (M-1)
Lewisite oxide
Lime, chlorinated

Magnesium
Magnesium hydroxide
Malathion
Manganese
Mercaptodiacetic acid
Mercuric chloride
Mercury
Methane dichloride
Methanethiol
Methanethiol, sodium salt
Methomyl
N-Methylacetoacetamide
Methyl acetylacetate
2-Methylalanine
Methylarsonic acid
2-Methylbenzyl acetoacetate
alpha-Methylbenzyl-2-chloroacetoacetate
Methyl cyclohexane
1-Methyl-1,3-cyclopentadiene
Methylethyl ketone
N-Methylformamide
Methylhydrazine
Methylmercury salts
Methyl naphthalene
Methyl parathion
Methylphosphonic acid
Methylphosphonic acid, disodium salt
Methyl phosphonic acid, isopropyl ester
Methyl phosphonic dichloride
Methylthioacetaldoxime
Mineral oil
Monomethyl chloroacetoacetamide
Monomethyl dichloroacetoacetamide
Monopropellant hydrazine
Mustard

Table 1 Comprehensive List of Chemicals Included in the August 1988 RMA Chemical Index

NP gel
Naphtha
Nitrate
Nitric acid
Nitric acid/Sulfuric acid (Mixed)
Nitrite
N-Nitromethylamine
4-Nitrophenol
4-Nitrophenol, sodium salt
p-Nitrophenyl diethylphosphate
Nitrous acid, ammonium salt

Octachlorocyclopentene
1,4-Oxathiane
3-Oxo-butanoic acid
2,2'-Oxybisethanol
Oxychlordane

Pentachloroacetophenone
Pentachlorobenzene
Pentachlorophenol
2-Pentanone
Peroxyacetic acid
Peroxybenzoic acid
Petroleum spirits
Phenanthrene
Phenolics
alpha-Phenylethyl alcohol
Phosdrin
Phosgene
Phosphoric acid
Phosphoric acid, 2,2-dichloroethenyl methyl octyl ester
Phosphoric acid, diethyl ester
Phosphoric acid, tributyl ester
Phosphoric acid, triphenyl ester
Phosphorus
Photodieldrin
Piperazine
Planavin
Potassium
PT-1 Mix
Pyrene

Table 1 Comprehensive List of Chemicals Included in the August 1988 RMA Chemical Index

Sarin
Shell nitrogen solution
Shell poultry spray
Sodium
Sodium bicarbonate (1:1)
Sodium bromate
Sodium carbonate (2:1)
Sodium chloride
Sodium fluoride
Sodium hydroxide
Sodium hypochlorite
Sodium methylate (alcohol mixture)
Sodium nitrite
Sodium silicate
Sodium sulfate (2:1)
Sodium sulfite (2:1)
Sodium sulfonate
Sodium thiosulfate
Sulfate
Sulfonic acid
Sulfur
Sulfur chloride
Sulfur dichloride
Sulfur dioxide
Sulfur tetrachloride
Sulfuric acid
Sulfuric acid, fuming
Sulfurous acid
Sulfuryl chloride

p,p'-TDE
Tetrachlorobenzene
1,1,2,2-Tetrachloroethane
1,1,2,2-Tetrachloroethylene
Thickener M1
Thickener M2
beta-Thiodiglycol
Thionyl chloride
Toluene
Tributylamine
Trichloroacetic acid
2,2',4'-Trichloroacetophenone
2,2',5'-Trichloroacetophenone
2,4',5'-Trichloroacetophenone
unsym-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane

Table 1 Comprehensive List of Chemicals Included in the August 1988 RMA Chemical Index

Trichloroethylene
Trichloropropene
2,4,6-Trichlorotriazine
Triethyl phosphate
Triethyl phosphite
Trihydroxytriethylamine
Trimethylbenzene
Trimethylhydrazine
2,3,5-Trimethyl phenol
3,4,5-Trimethyl phenol
Trimethyl phosphate
Trimethyl phosphite
Tris-2-chlorovinylarsine

Urea

Vinyl chloride
VX

Wheat rust, TX

Xylene

Zinc
Zinc oxide

Table 2 Target Analytes Included in RMA Remedial Investigation and Endangerment Assessment Programs

Explanatory Notes

Note: [a] Program indicates for which RI or EA investigatory program the compound is considered a target analyte.

1. Ground-water target analyte for remedial investigation
2. Soil target analyte for remedial investigation
3. Analytes designated for Off-Post ground-water endangerment assessment
4. Analytes designated for On-Post soil endangerment assessment
5. Agent degradation product
6. Laboratory method not certified for this parameter
7. Considered as analyte only for selected sites

[b] Listed as 2-[bis(1-methylethyl)amino]-ethanethiol in Index

[c] Listed as ethylmethylphosphonate in Index; occurs as the phosphonate in environment

[d] Listed as isopropylmethyl phosphonate in Index; occurs as the phosphonate in environment

[e] Listed as methane dichloride in Index

[f] Listed as hexone in Index

[g] Listed as dimethyl hydrazine in Index

[h] Listed as di-n-propylnitrosamine in Index

[i] Listed as ethyl parathion in Index

[j] Listed as Chlorfenvinphos In Index

[k] Listed as mercaptodiacetic acid in Index

[l] Listed as DDVP in Index

Table 2 Target Analytes included in RMA Remedial Investigation and Endangerment Assessment Programs

Analyte	Program[a]
Aldrin	1,2,3,4
Alkalinity (as $CaCO_3$)	1
Arsenic	1,2,3,4
Atrazine	2,4
Benzene	1,2,3,4
Benzothiazole	1,4
Bicycloheptadiene	2,4
Biscarboxymethyl sulfone	5,6
Biscarboxymethyl sulfoxide	5,6
Cadmium	1,2,3,4
Calcium	1
Carbon tetrachloride	1,2,4
Chlordane	1,2,4
Chloride	1,2,4
Chloroacetic acid	2,4,5
Chlorobenzene	1,2,4
Chloroform	1,2,3,4
2-Chlorovinyl arsonic acid	5,6
2-Chlorovinyl arsonous acid	5,6
p-Chlorophenylmethyl sulfide	1,2,4

Table 2 Target Analytes included in RMA Remedial Investigation and Endangerment Assessment Programs

Analyte	Program[a]
p-Chlorophenylmethyl sulfone	1,2,4
p-Chlorophenylmethyl sulfoxide	1,2,3,4
Chromium	1,2,4
Copper	1,2,4
DDE	1,2,4
DDT	1,2,4
1,2-Dibromo-3-chloropropane	1,2,3,4
1,1-Dichloroethane	1,2,4
1,2-Dichloroethane	1,2,4
1,1-Dichloroethylene	1,2,4
1,2-Dichloroethylene	1,2,4
Dicyclopentadiene	1,2,4
Dieldrin	1,2,3,4
2-(Diisopropylamino)-n-ethanethiol[b]	5,6
2-(Diisopropylamino)-n-ethyl sulfonate	5,6
Diisopropylmethyl phosphonate	1,2,3,4
Dimethyl arsenic acid	5,6
Dimethyl disulfide	1,2,4
1,1-Dimethyl hydrazine (UDMH)	2,7
Dimethyl mercury (salts)	5,6
Dimethyl methyl phosphonate	1,2,4
1,4-Dithiane	1,2,4

Table 2 Target Analytes included in RMA Remedial Investigation and Endangerment Assessment Programs

Analyte	Program[a]
Endrin	1,2,4
Ethylbenzene	1,2,4
Ethylmethyl phosphonate	5,6
Ethylmethyl phosphonic acid[c]	5,6
Fluoride	1,2,4,5
Fluoroacetic acid	2,5,6
Hexachlorocyclopentadiene	1,2,4
Hydrazine	2,7
Isodrin	1,2,4
Isopropylmethyl phosphonic acid[d]	5
Isopropylmethyl phosphonate	2,4,5
Lead	1,2,4
Lewisite	4,7
Lewisite oxide	4,7
Magnesium	1
Malathion	2,4
Mercury	1,2,4
Methyl arsonic acid	5,6
Methylene chloride[e]	1,2,4

Table 2 Target Analytes included in RMA Remedial Investigation and Endangerment Assessment Programs

Analyte	Program[a]
Methyl hydrazine	2
Methylisobutyl ketone[f]	1,2,4
Methyl mercury (salts)	5,6
Methylphosphonic acid	2,4,5
Mustard	4,7
Nitrogen (as nitrate)	1
N-Nitrosodimethylamine[g]	2,4,7
N-Nitrosodi-n-propylamine[h]	2,7
1,4-Oxathiane	1,2,4
Parathion[i]	2,4
Potassium	1
Sarin	4,7
Sodium	1
Sulfate	1,2
Supona[j]	2,4
1,1,2,2-Tetrachloroethylene	1,2,3,4
beta-Thiodiglycol	2,4,5
2,2-Thiodiglycolic acid[k]	2,4,5

Table 2 Target Analytes included in RMA Remedial Investigation and Endangerment Assessment Programs

Analyte	Program[a]
Toluene	1,2,4
1,1,1-Trichloroethane	1,2,4
1,1,2-Trichloroethane	1,2,4
Trichloroethylene	1,2,4
Trimethyl phosphate	6
Vapona[1]	2,4
Xylene	1,2,4
Zinc	1,2,4

Table 3 Nontarget Compounds Warranting Further Investigation

Compound	Media of Detection
2-Butoxyethanol	soil
Caprolactam[1]	ground water
Fluoranthene	soil
Hexachlorobenzene	soil
Hexachlorobutadiene	soil, ground water
4-Hydroxy-4-methyl-2-pentanone	soil, ground water
Methyl cyclohexane	soil
Methyl naphthalene	soil
1-Methyl-1,3-cyclopentadiene	soil
2,2'-Oxybisethanol	soil
Pentachlorobenzene	soil
2-Pentanone	soil
Phenanthrene	soil
Phosphoric acid, tributyl ester	soil
Phosphoric acid, triphenyl ester	soil
Pyrene	soil
Tetrachlorobenzene	soil
1,1,2,2-Tetrachloroethane	soil, ground water
Trichlorobenzene	soil
Trichloropropene	soil

[1] Listed as 2H-Azepin-2-one,hexahydro in Chemical Index.

Primary name: **Acetone**

Synonym: Dimethyl ketone; Ketone propane; Dipropanone

CAS RN: 676421

Formula: C_3H_6O

Information sources: Shell/Army

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 67); CAR, Sites 1-13 and 2-18 (73, p. 14); CAR, Site 26-6 (78, p. 17).

Monitoring History: No information found.

Environmental fate: Compound decomposes rapidly in soil, half life 1 month. Low persistency. Miscible in water. Vapor pressure 270 mm at 30° C.

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): No

References: 1, 27, 29, 31, 41, 42, 66, 73, 78, 128

Primary name: **Acetonitrile**

Synonym: **Methyl cyanide**

CAS RN: 75058

Formula: CH_3CN

Information sources: **Shell**

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: **Not included in environmental program.**

Environmental fate: **Miscible in water. Vapor pressure 100 mm at 27° C. Will react with water, steam, or acids to produce toxic and flammable vapors.**

Toxicity: **Toxicity score, 3 (RTECS).**

Included on target list(s): **No**

References: **31, 37, 42, 44, 78, 128**

Primary name: **Acetylene tetrachloride**

Synonym: Tetrachloroethane

CAS RN: 79345

Formula: C_2HCl_4

Information sources: Army

History of use, production, disposal & quantities:
Correspondence re: RMA Litigation from E.J. McGrath (48).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Very sparingly soluble in water; at 25°C, 1 g dissolves in 350 ml of water. Any water can cause appreciable hydrolysis even at room temperature, and both hydrolysis and oxidation become comparatively rapid above 110°C.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 31, 37, 48, 128

Primary name: **Adamsite**

Synonym: Diphenylamine chloroarsine; phenarsazine chloride

CAS RN: 578949

Formula: $C_{12}H_9AsNCl$

Information sources: Army

History of use, production, disposal & quantities: CAR, Chemical Sewers - North Plants and South Plants (90, p. 10); CAR, North Plants (127, pp. 10, 11, 20).

Monitoring history: No information found.

Environmental fate: Very slightly soluble in water, not volatile. Hydrolysis rate quite rapid in aerosol form. Hydrolysis products - diphenylarsenious oxide and hydrogen chloride. The oxide is poisonous if taken internally. Not persistent.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 32, 52, 90, 127

Primary name: **Adhesive VI and VIII**

Synonym:

CAS RN: Not available

Formula: Not available. No ingredient information available.

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #13 (46).

Monitoring history: Not included in environmental monitoring program. Unlikely to be detectable by direct analysis.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 46

Primary name: **Aerozine 50**

Synonym:

CAS RN: 8065756

Formula: 50/50 mixture of 1,1-dimethyl hydrazine and hydrazine.

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 1-7 (92, p. 12); CAR, Hydrazine Blending and Storage Facility (126, p. 1-7).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 43, 92, 126

Primary name: **Akton**

Synonym: o-(2-Chloro-1-(2,5-dichlorophenyl)-vinyl)0,0-diethylphosphorothioate; 0,0 - Diethyl 0-(2-Chloro-1,2,5-dichlorophenylvinyl) phosphorothioate

CAS RN: 1757182

Formula: $C_{12}H_{14}C_{13}O_3PS$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: $T_{1/2}$ in water, pH 9.1, 35° C = 140 hrs and at pH 1.1 greater than 400 hrs. $T_{1/2}$ soil greater than 50 days (Moderate persistency in soil).

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 27, 31, 128

Primary name: **Aldrin**

Synonym: Aldrex; Compound 118; ENT 15,949

CAS RN: 309002

Formula: $C_{12}H_8Cl_6$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 36-7 (63, p. 12); CAR, Site 36-10 (64, p. 8); CAR, Site 36-17 (66, p. 67); CAR, South Plants Manufacturing Complex (68, p. 7); CAR, Sites 1-13 and 2-18 (73, p. 8); CAR, Site 2-6 (75, p. 10); CAR, Site 26-6 (78, p. 17); CAR, Site 2-1 (82, p. 11); CAR, Site 2-17 (83, p. 14); CAR, Chemical Sewers - North Plants and South Plants (90, p. 20); CAR, Section 3 - Nonsource (113, p. 19); CAR, Army Spill Sites (125, pp. 21, 32).

Monitoring history: Monitored in soil and ground water. Present in South Lakes sediment.

Environmental fate: Long lived in soil and water. Decomposes to Dieldrin in soil ($t_{1/2}$ 4 to 5 years). Aqueous solubility about 1 mg/L. Found in high concentrations in Section 36

Toxicity: Toxicity score, 4 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 1, 11, 25, 27, 29, 31, 33, 42, 43, 54, 55, 63, 64, 66, 68, 73, 75, 78, 82, 83, 90, 113, 125, 128

Primary name: Allyl alcohol

Synonym: 2-Propene-1-ol

CAS RN: 107186

Formula: C_3H_6O

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Rapidly degraded by soil microorganisms. Miscible in water. Vapor Pressure 20 mm at 20° C.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 41, 128

Primary name: **Aluminum hydroxide**

Synonym:

CAS RN: 21645512

Formula: $Al(OH)_3$

Information sources: Army

History of use, production, disposal & quantities:
Communication from Dr. Eugene Meyer (52).

Monitoring history: Found in Section 26 Waste Pond as precipitate. Natural occurrence of compound obscures value as a tracer for chemical contaminants.

Environmental fate: Practically insoluble in water. Absorbs acids.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 22, 37, 52

Primary name: **alpha-Amino-iso-butyronitrile**

Synonym: Iso-butyronitrile, 2-amino

CAS RN: not available

Formula: $C_4H_8N_2$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: No monitoring data.

Environmental fate: Undergoes relatively rapid biodegradation ($t_{1/2}$ = ca. 6 months). Aqueous solubility 1,000 mg/L.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27, 42, 78

Primary name: **Ammonia**

Synonym: Ammonia, Anhydrous

CAS RN: 7664417

Formula: NH_3

Information sources: Shell/Army

History of use, production, disposal & quantities: CAR, Section 25 - Nonsource Area (99, p. 8); CAR, Hydrazine Blending and Storage Facility (126, pp. 1-13).

Monitoring history: Included in ground-water monitoring as part of standard water quality constituent analyses.

Environmental fate: Although a gas, it is highly soluble in water and was included as a component in some aqueous effluents. Solubility 531,000 mg/L at 20° C. Ammonia rapidly oxidizes, biochemically, to nitrate in soils and water. Vapor pressure 8.7 atm at 20° C.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 41, 99, 126, 128

Primary name: **Ammonium chloride**

Synonym:

CAS RN: 12125029

Formula: NH_4Cl

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78, pp. 16, 17).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Solubility 26% at 15° C. Ammonium ion quickly oxidizes to nitrate in soil. See Ammonia, Nitrate, and Chloride entries.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 12, 31, 37, 42, 52, 78, 128

Primary name: **Ammonium nitrate**

Synonym:

CAS RN: 6484522

Formula: NH_4NO_3

Information sources: Shell

History of use, production, disposal & quantities: Denver Plant Waste Disposal Survey (42); Shell Response to US Interrogatory #15 (44).

Monitoring history: No information found.

Environmental fate: One gram dissolves in 0.5 ml of water. Heat and confinement may cause an explosion. Ammonium ion quickly oxidizes to nitrate in soil.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 37, 42, 44, 128

Primary name: **Ammonium sulfate**

Synonym:

CAS RN: 7783202

Formula: $(NH_4)_2SO_4$

Information sources: Shell

History of use, production, disposal & quantities: Denver Plant Waste Disposal Survey (42); Shell Response to US Interrogatory #15 (44).

Monitoring History: Not included in environmental monitoring program.

Environmental fate: Ammonium ion quickly oxidizes to nitrate in soil. Sulfate is a natural component of soil and water.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 37, 42, 44, 128

Primary name: **Ammonium sulfite**

Synonym: Sulfurous acid; diammonium salt

CAS RN: 10196040

Formula: $(NH_4)_2SO_3.H_2O$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78 p. 17).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Under the influence of air and heat, loses all its water of crystallization and is gradually oxidized to $(NH_4)_2SO_4$. Soluble in 1 part water.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 31, 37, 42, 44, 78

Primary name: **Antimony**

Synonym:

CAS RN: 7440360

Formula: Sb

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 18).

Monitoring history: Included in trace element analysis of plants and water. Not detected in environmental monitoring program.

Environmental fate: Density 6.68. Melting point 630° C.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 23, 31, 37, 66, 128

Primary name: **Antimony (III) chloride**

Synonym: Antimony trichloride

CAS RN: 10025919

Formula: $SbCl_3$

Information sources: Army

History of use, production, disposal & quantities: History of Pollution Sources and Hazards at RMA (10); Communucation with Dr. Eugene Meyer (52).

Monitoring history: No information found.

Environmental fate: Fumes in air. One gram dissolves in 10.1 ml H_2O at 25°. Gradual hydrolysis to the oxychloride, SbOCl.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 10, 31, 37, 52, 128

Primary name: **Arsenic**

Synonym:

CAS RN: 7440382

Formula: As

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-1 (60, p. 12); CAR, Site 36-4 (61, p. 9).

Monitoring history: Significant contamination in Section 36. Component of waste in Basin F and found in nearby wells. Included as an analyte in the monitoring program.

Environmental fate: Insoluble in H_2O. Vaporization apparent at 100^{o} C.

Toxicity: Toxicity score, 4 (USEPA, 1984). EPA carcinogenic classification, A (human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 3, 4, 9, 31, 37, 44, 54, 55, 60, 61, 129

Primary name: **Arsenic chloride**

Synonym: **Arsenic trichloride; AT**

CAS RN: 7784341

Formula: $AsCl_3$

Information sources: **Army**

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 11).

Monitoring history: **Arsenic detected in wells near Basin F.**

Environmental fate: **AT rapidly hydrolyzes and would appear in the form of other arsenic compounds.**

Toxicity: **Toxicity score, 4 (USEPA, 1984).**

Included on target list(s): **Ground-Water and Soil**

References: **2, 10, 31, 52, 66, 129**

Primary name: **Arsenic trioxide**

Synonym: ATO

CAS RN: 1327533

Formula: As_2O_3

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 21).

Monitoring history: Arsenic included in water and soil monitoring program.

Environmental fate: Sparingly and extremely slow solubility in cold water. Soluble in 15 parts boiling water.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): Ground-Water and Soil

References: 10, 31, 37, 66, 128

Primary name: **Atrazine**

Synonym: 2-Chloro-4-ethylamino-6-isopropylamino-S-triazine

CAS RN: 1912249

Formula: $C_8H_{14}ClN_5$

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #13 (46).

Monitoring history: Detected in soil samples.

Environmental fate: Hydrolysis at pH 7 and 25° C, $t_{1/2}$ = 2.5 hrs. Persistence in soil: $t_{1/2}$ = 20 - 100 days. Biodegradation - persistent. Solubility H_2O at 25°C = 33 mg/L.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, D (not classified).

Included on target list(s): Soil

References: 10, 30, 31, 33, 45, 46, 54, 56, 128

Primary name: **2H-Azepin-2-one,hexahydro**

Synonym: Caprolactam

CAS RN: 105602

Formula: $C_6H_{11}NO$

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring history: Tentatively identified as nontarget analyte in ground-water RI program.

Environmental fate: Freely soluble in water, methanol, ethanol, ether.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 31, 59, 128

Primary name: **Azodrin**

Synonym: Phosphoric acid dimethyl [1-methyl-3-(methylamino)-3-oxo-1-propenyl] ester

CAS RN: 919448

Formula: $C_7H_{14}NO_5P$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 36-7 (63, p. 12).

Monitoring history: Detected in RMA environmental samples.

Environmental fate: Miscible in H_2O. Slowly hydrolyzes. Hydrolysis at 38°C, $t_{1/2}$ = 22-23 days in pH 1-7 range. Solubility at 25°C = 8100 mg/L.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 1, 11, 27, 29, 30, 31, 34, 42, 44, 63, 128

Primary name: **Barium**

Synonym:

CAS RN: 7440393

Formula: Ba

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring history: Included in trace metal analysis of water and plants.

Environmental fate: Naturally occurring.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 21, 23, 128

Primary name: **Benzene**

Synonym: Benzol; cyclohexatriene; phene; phenyl hydride; pyrobenzol

CAS RN: 71432

Formula: C_6H_6

Information sources: Shell/Army

History of use, production, disposal & quantities: CAR, Site 1-10 (71, p. 13); CAR, Sites 1-13 and 2-18 (73, p. 11); CAR, Site 26-6 (78, p. 17); CAR, Section 5 - Nonsource Area (114, p. 15).

Monitoring history: Included in monitoring program.

Environmental fate: Soil $t_{1/2}$ approximately 1 month. Aqueous solubility 1,780 mg/L. Rapidly volatilized, $t_{1/2}$ 4.81 hrs. Biodegradation - somewhat persistent. Mobile in the subsurface.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, A (human carcinogen).

Included on target list(s): Ground-water and Soil.

References: 1, 10, 14, 27, 31, 33, 35, 36, 42, 54, 55, 71, 73, 78, 114, 128

Primary Name: **Benzothiazole**

Synonym: Benzosulfonazole; 1-thia-3-azaindene; BTA

CAS RN: 95169

Formula: C_7H_5NS

Information sources: Not assigned

History of use, production, disposal, & quantities: Assessment of Contaminant Migration from Potential Contaminant Sources (3).

Monitoring history: Listed as an analyte in reference 8 and reference 15. Detected in ground water and was found to have the widest distribution across the arsenal of the organo-sulfur compounds (Reference 15).

Environmental fate: Slighty soluble in H_2O, freely soluble in alcohol and carbon disulfide. Volatile with steam. Biodegradation - highly persistent.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): Ground-water

References: 3, 8, 15, 31, 33, 128

Primary name: **Benzoyl peroxide**

Synonym:

CAS RN: 94360

Formula: $(C_6H_5CO)_2O_2$

Information sources: **Lessee prior to Shell**

History of use, production, disposal & quantities: **Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).**

Monitoring history: **No information found.**

Environmental fate: **Strong oxidizing agent. Decomposes in contact with oxidizable substrates.**

Toxicity: **Toxicity score, 2 (RTECS).**

Included on target list(s): **No**

References: **27, 31, 128**

Primary name: Bicyclo(2.2.1)hepta-2,5,-diene

Synonym: Bicycloheptadiene; BCH; Norbornadiene; M101

CAS RN: 121460

Formula: C_7H_8

Information sources: Shell

History of use, production, disposal & quantities: CAR Chemical Sewers - North Plants and South Plants (90, p. 18).

Monitoring history: Included as analyte in monitoring program.

Environmental fate: Bycycloheptadiene can undergo additional rearrangement in aqueous media to nortricyclenes. Soil $t_{1/2}$ approximately 1 year. Solubility at 25° C 785 mg/L.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): Ground-water

References: 1, 27, 29, 30, 31, 36, 42, 90, 128

Primary name: **Bis-carboxymethyl sulfone**

Synonym: Acetic acid, 2,2-sulfonylbis-

CAS RN: 123455

Formula: $C_4H_6O_6S$

Information sources: Not assigned

History of use, production, disposal & quantities: Geraghty & Miller, Inc. Review of Portions of the Rocky Mountain Arsenal Microfilm Database (43).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 31, 43

Primary name: **Bis-carboxymethyl sulfoxide**

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Not assigned

History of use, production, disposal & quantities: Geraghty & Miller, Inc. Review of Portions of the Rocky Mountain Arsenal Database (43).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 31, 43

Primary name: **Bis(2-chlorovinyl)chloroarsine**

Synonym: **Lewisite II**

CAS RN: 40334698

Formula: $C_4H_4AsCl_3$

Information sources: Army

History of use, production, disposal & quantities: HCIC Report: Literature Reviews on 54 RMA On-Post Contaminants (30).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: When heated emits toxic fumes of arsenic and Cl^-.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 30, 50

Primary name: 2-[Bis(1-methy(ethyl)amino]-Ethanethiol

Synonym: 2-(Diisopropylamino)-n-ethanethiol

CAS RN: 5842079

Formula: $C_8H_{19}NS$

Information Sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants: I. Toxicology and Ecological Hazards of 16 Substances at RMA (2).

Monitoring history: No information found.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 2, 31

Primary name: **Bisphenol A**

Synonym: 4,4'-Isopropylidenediphenol

CAS RN: 80057

Formula: $C_{15}H_{16}O_2$

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #13 (46).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Not documented.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 37, 46, 128

Primary name: **Bladex**

Synonym: 2-Chloro-4(1-cyano-1-methylethylamino)-6-ethyl-amino-s-trazine

CAS RN: 21725462

Formula: $C_9H_{13}N_6Cl$

Information sources: Shell

History of use, production, disposal & quantities: Report of Readily Available Data on 109 Compounds Associated with Shell Chemical Company Operations at Rocky Mountain Arsenal (1); Denver Plant Waste Disposal Survey (42).

Monitoring history: No information found.

Environmental fate: $T_{1/2}$ in soil at 23° C, 14 to 16 days. Decomposition product more stable, approximate 5 year half life.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 11, 27, 31, 42, 128

Primary Name: **Bromic acid, potassium salt**

Synonym: **Potassium bromate**

CAS RN: 7758012

Formula: $KBrO_3$

Information sources: Not assigned

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Powerful oxidizer. Soluble in 12.5 parts water, 2 parts boiling water.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 27, 37, 128

Primary name: Bromide

Synonym:

CAS RN: 24959679

Formula: Br^-

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Included in environmental monitoring program as bromide ion.

Environmental fate: Bromine is a highly volatile corrosive liquid. Would be degraded to bromide ion in soil and water.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 128

Primary name: alpha-Bromoallyl alcohol

Synonym:

CAS RN: 598196

Formula: C_3H_5BrO

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary Name: 3-Bromo-1-chloro-1-propene

Synonym: Chlorobromopropene

CAS RN: 3737006

Formula: C_3H_4BrCl

Information sources: Shell

History of use, production, disposal, & quantities: Shell Response to US Interrogatory #13 (46).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Volatile. Resistant to biodegradation.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 46

Primary name: 2-Butoxyethanol

Synonym: n-Butoxyethanol; Ethylene glycol; Monobutyl ether

CAS RN: 111762

Formula: $C_6H_{14}O_2$

Information sources: Army/Shell

History of use, production, disposal & quantities: No information located.

Monitoring history: Tentatively identified as nontarget analyte in RI soil program.

Environmental fate: Solubility at 25° C is 50,000 ppm. May biodegrade at moderately fast rate.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 31, 59, 128

Primary name: Cadmium

Synonym:

CAS RN: 7440439

Formula: Cd

Information sources: Army

History of use, production, disposal & quantities: CAR, Section 20 - Nonsource Area (98, p. 8, 9).

Monitoring history: Included in trace metal analysis of water and plants. Detected with high Zn concentrations in Section 36 soil.

Environmental fate: Cd is a metal naturally associated with Zn. Insoluble in water. Slowly oxidized by moist air to CaO.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogenic classification, B1 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 23, 25, 31, 37, 54, 56, 98, 128

Primary name: **Calcium**

Synonym:

CAS RN: 7440702

Formula: Ca

Information sources: **Not assigned**

History of use, production, disposal & quantities: **Assessment of Contaminant Migration from Potential Contamination Sources (3); Problem Definition Studies on Potential Environmental Pollutants (2).**

Monitoring history: **Calcium residues are evident in the lime pits and elsewhere in soils. Calcium is enriched in some water samples. It is an analyte in the ground-water monitoring program on the arsenal.**

Environmental fate: **Calcium is a natural constituent of soils and waters.** $Ca(OH)_2$ **and** $CaCO_3$ **were used for acid neutralization at RMA and their residues are still evident. Reacts with water, alcohols and dilute acids with evolution of hydrogen.**

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): Ground-Water

References: 2, 3, 31, 36, 128

Primary Name: **Calcium bromate**

Synonym: **Bromic acid, calcium salt**

CAS RN: 10102757

Formula: $Ca(BrO_3)_2$

Information sources: **Shell**

History of use, production, disposal & quantities: **Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).**

Monitoring history: **No information found.**

Environmental fate: **Solubility, greater than 50,000 mg/L. Nonvolatile. Decomposition product, $t_{1/2}$ 6 mo. to 1 yr.**

Toxicity: **Toxicity score, not rated.**

Included on target list(s): **No**

References: **27**

Primary Name: **Calcium carbide**

Synonym:

CAS RN: 75207

Formula: CaC_2

Information sources: Shell/Army

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 8); CAR, Site 1-5 (70, p. 11).

Monitoring history: No information found.

Environmental fate: Reacts with H_2O to form acetylene and calcium hydroxide. $T_{1/2}$ less than 1 month.

Toxicity: Toxicity score, not rated.

Included on target lists(s): No

References: 1, 10, 27, 66, 70

Primary Name: **Calcium chloride**

Synonym:

CAS RN: 10043524

Formula: $CaCl_2$

Information sources: **Army/Shell**

History of use, production, disposal & quantities: **CAR, Site 1-7 (92, p. 12)**

Monitoring history: **No information found.**

Environmental fate: **Calcium chloride is highly water soluble and is deliquescent. Contributes calcium and chloride ions to soil and water.**

Toxicity: **Toxicity score, 2 (RTECS).**

Included on target lists(s): **No**

References: **10, 31, 42, 92, 128**

Primary Name: Carbon tetrachloride

Synonym: Perchloromethane; Tetrachloromethane

CAS RN: 56235

Formula: CCl_4

Information sources: Shell/Army

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 16).

Monitoring history: Included as an analyte in environmental monitoring program.

Environmental fate: Resistant to microbial degradation. Does not hydrolyze. Vapor pressure, 90 mm at 20° C. Solubility, 800 mg/L at 20° C. Log octanol/water partition coefficient, 2.64 at 20° C.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 1, 10, 15, 27, 31, 34, 41, 42, 52, 54, 55, 78, 128

Primary Name: 2(1'-Carboxyl-1'-methyl-ethyl-amino)-4,6-dichloro-s-triazine

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary Name: **Chloral hydrate**

Synonym: 2,2,2-Trichloro-1,1-ethanediol

CAS RN: 302170

Formula: C_2HOCl_3:$C_2H_3O_2Cl_3$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: No information found.

Environmental fate: Chloral forms chloral hydrate with water. Oxidized to trichloroacetic acid in a few days in soil. Microbial degradation slow, $t_{1/2}$ is less than or equal to 5 years.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 12, 27, 31, 42, 78, 128

Primary name: Chlorate ion

Synonym:

CAS RN: 14866683

Formula: ClO_3^-

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: Included as analyte in monitoring program.

Environmental fate: Hypochlorite disproportionates in solution to form chlorate ions. Chlorate eventually decomposes to yield chloride.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 2, 31, 34, 128

Primary Name: Chlordane

Synonym: 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methano-1H-indene

CAS RN: 57749

Formula: $C_{10}H_6Cl_8$

Information sources: Shell

History of use, production, disposal & quantities: CAR, South Plants Manufacturing Complex (68, p. 7); CAR, Sites 1-13 and 2-18 (73, p. 8).

Monitoring history: Detected in the southwest section of Section 36, near the lime pits.

Environmental fate: Epoxidized to chlordene epoxide by soil bacteria. Slow reaction, compound resistant to decomposition. Solubility, 1.85 mg/L at 25° C. Bioaccumulates.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogen classification B2 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 1, 9, 25, 31, 35, 54, 55, 68, 73, 128

Primary Name: **Chlorfenvinphos**

Synonym: Supona insecticide; 2-Chloro-1-(2,4-dichlorophenyl)vinyl diethyl phosphate; Diethyl 1-(2,4-dichlorophenyl)-2-chlorovinyl phosphate

CAS RN: 470906

Formula: $C_{12}H_{14}Cl_3O_4P$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Included in environmental monitoring program.

Environmental fate: Vapor Pressure, 1.7×10^{-77} mm at 25° C. Solubility, 145 mg/L at 23° C. Miscible with organic solvents.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): Soils

References: 1, 11, 27, 31, 41, 43, 45, 128

Primary Name: **Chloride**

Synonym:

CAS RN: 16887006

Formula: Cl

Information sources: **Army/Shell**

History of use, production, disposal & quantities: **Problem Definition Studies on Potential Environmental Pollutants (2); Assessment of Contaminant Migration from Potential Contamination Sources (3).**

Monitoring history: **The ground-water system in Basin A area has a high concentration of Cl. There is an extremely high concentration in Basin F with elevated levels in adjacent wells southeast of Basin F. Pollutant plume found extending 5 to 8 miles north of RMA. Prevalent throughout waste basin area. Plume extends past the O'Brian Canal. Since Basin F's construction, concentrations in groundwater have been decreasing.**

Environmental fate: **Chloride often considered tracer of ground-water flow. See specific salts for fate information.**

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): Ground-Water and Soil

References: 2, 3, 4, 7, 9, 31, 128

Primary Name: Chlorinated paraffin, Chlorocosane

Synonym:

CAS RN: 63449398 (Cereclor)

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 9).

Monitoring history: No information found.

Environmental fate: Chlorinated paraffin is resistant to microbial decomposition. Immobile in soil and very slightly soluble in water.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 10, 66

Primary Name: **Chlorinated phenol**

Synonym:

CAS RN: Not available

Formula: Not specified

Assignment: Shell

History of use, production, disposal & quantities: "Blue Bottle," Study of the Future of RMA (12).

Monitoring history: Included in environmental monitoring program as part phenols analysis.

Environmental fate: Not documented.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 12, 31, 128

Primary Name: Chloroacetaldoxime

Synonym: Acetaldehyde oxime, chloro-

CAS RN: 683589

Formula: C_2H_4ClNO

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Hydrolyzes. Resistant to microbial degradation, $t_{1/2}$ soil less than 2 yrs. Aqueous solubility, greater than 50,000 mg/L.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27

Primary name: Chloroacetic acid

Synonym: Monochloroacetic acid

CAS RN: 79118

Formula: $C_2H_3ClO_2$

Assignment: Army

History of use, production, disposal & quantities: No information located.

Monitoring history: No information located.

Environmental fate: When heated to decomposition emits toxic fumes of Cl^-. Very soluble in water.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): Soil

References: 31, 37, 128

Primary Name: **Chloroacetoacetic acid**

Synonym:

CAS RN: Not listed

Formula: Not available

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Highly water soluble. Slightly volatile. Microbially degraded.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary Name: 2-Chloroacetophenone

Synonym:

CAS RN: 532274

Formula: C_8H_7ClO

Information Sources: Army

History of use, production, disposal & quantities: CAR, North Plants (127, p. 17).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Vapor pressure, 5.4×10^{-3} mm at 20° C. Practically insoluble in water.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 37, 48, 127, 128

Primary Name: **Chlorobenzene**

Synonym: Monochlorobenzene

CAS RN: 108906

Formula: C_6H_5Cl

Information sources: Army

History of use, production, disposal & quantities: CAR, Sites 1-13 and 2-18 (73, p. 17); CAR, Site 26-6 (78, p. 17); CAR, Sanitary Sewer - South Plants (89, p. 13).

Monitoring history: A component of soil and ground-water monitoring programs. Found in environmental samples.

Environmental fate: Solubility, 500 mg/L. Vapor pressure, 8.8 mm at 20° C. Slow microbial degradation. Biodegradation, persistent. Log octanol/water partition coefficient 2.84 at 20° C.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, C (possible human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 10, 13, 27, 31, 33, 41, 54, 56, 73, 78, 89, 128

Primary Name: 4-Chlorobenzenethiol

Synonym: p-Chlorobenzenethiol

CAS RN: 106547

Formula: C_6H_5ClS

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Fairly rapidly degraded by soil microorganisms, $t_{1/2}$ less than 6 months. Slightly soluble in H_2O. Slightly volatile.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 128

Primary Name: **Chlorobromopropane**

Synonym:

CAS RN: 1097061 (omega-chlorobromopropane)
3017956 (1-Chloro-2-bromopropane)

Formula: C_3H_6BrCl

Information sources: Shell

History of use, production, disposal & quantities:

Correspondence re: RMA Litigation (48).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Volatile. Resistant to biodegradation.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 48, 128

Primary Name: 4-Chloro-3,5-dinitrophenyl methyl sulfone

Synonym: Dinitro; SD 11829

CAS RN: Not available

Formula: $C_7H_5SO_6ClN_2$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 1-5 (70, p. 11); CAR, Sites 1-13 and 2-18 (73, p. 18).

Monitoring history: No information found.

Environmental fate: Insoluble in H_2O. Reacts violently to strong inorganic bases above 60° C. Hydrolyzed to relatively stable alcohol. Nonvolatile. $T_{1/2}$ 1 to 5 yrs.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27, 70, 73

Primary Name: **Chloroform**

Synonym: **Trichloromethane**

CAS RN: 67663

Formula: $CHCl_3$

Information sources: **Shell**

History of use, production, disposal & quantities: **CAR, Site 1-13 and 2-18 (73, p. 14); CAR, Site 26-6 (78, p. 17).**

Monitoring history: **No information found.**

Environmental fate: **Stable in the environment. Aqueous solubility, 8,000 mg/L at 20° C. Vapor pressure, 160 mm at 20° C. Biodegradation, highly persistent. Log octanol/water partition coefficient 1.97 at 20° C.**

Toxicity: **Toxicity score, 4 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).**

Included on target list(s): **Ground-Water and Soil**

References: **1, 5, 10, 12, 27, 31, 33, 41, 42, 54, 55, 73, 78, 128**

Primary Name: **2-Chloroisophorone**

Synonum: 2-chloro-3,5,5-trimethyl-2-cyclohexen-1-one

CAS RN: Not available

Formula: $C_9H_{13}OCl$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Degraded by microorganisms with $t_{1/2}$ less than 1 year. Various addition products possible in solution. Insoluble in H_2O. Slightly volatile.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27

Primary name: 2-Chloro-3-oxo-butanoic acid, methyl ester

Synonym: Methyl-2-chloroacetoacetate

CAS RN: 4755811

Formula: $C_5H_7ClO_3$

Assignment: Shell

History of use, production, disposal & quantities: Readily Available Data on 16[illegible] Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27); Denver Plant Waste Disposal Survey (42).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Hydrolyzes. Degraded by microorganisms, $t_{1/2}$ less than 6 months. Solubility, greater than 50,000 mg/L.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 12, 27, 42

Primary Name: **p-Chlorophenyl methyl sulfide**

Synonym: **CPMS; 4-Chlorophenyl methyl sulfide**

CAS RN: 123091

Formula: C_7H_7ClS

Assignment: **Shell**

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: **CPMS concentrations have been found in the pre-pilot plot in Section 36.**

Environmental fate: **Estimated aqueous solubility, 12 mg/L. Soil $t_{1/2}$, less than 6 months, oxidizes to analagous sulfoxide and sulfone.**

Toxicity: **Toxicity score, 3 (RTECS).**

Included on target list(s): **Ground-Water and Soil.**

References: **1, 25, 27, 28, 31, 42, 78, 128**

Primary Name: **p-Chlorophenyl methyl sulfone**

Synonym: **$CPMSO_2$, 4-Chlorophenyl methyl sulfone**

CAS RN: **98577**

Formula: $C_7H_7ClSO_2$

Information sources: **Shell**

History of use, production, disposal & quantities: **CAR, Site 36-7 (63, p. 12); CAR, Site 26-6 (78, p. 17).**

Monitoring history: **$CPMSO_2$ concentrations have been found in the pre-pilot plot in Section 36.**

Environmental fate: **Aqueous solubility estimated, 1,050 mg/L. Degraded by microorganisms. Stable in solution.**

Toxicity: **Toxicity score, 3 (RTECS).**

Included on target list(s): **Ground-Water and Soil**

References: **1, 3, 7, 25, 28, 31, 42, 63, 78, 128**

Primary Name: p-Chlorophenyl methyl sulfoxide

Synonym: CPMSO; 4-Chlorophenyl methyl sulfoxide

CAS RN: 934736

Formula: C_7H_7ClSO

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: CPMSO concentrations have been detected in the pre-pilot plot in Section 36.

Environmental fate: Aqueous solubility estimated, 1,200 mg/L. Oxidizes to analagous sulfone.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): Ground-Water and Soil.

References: 3, 25, 27, 28, 31, 42, 128

Primary Name: 2-Chlorovinylarsonic acid

Synonym: beta-chlorovinylarsonic acid

CAS RN: 6403844

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: No information found.

Environmental fate: Possibly formed by air oxidation of Lewisite oxide in soil; cannot be confirmed from the literature.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 2

Primary Name: **Chromic acid**

Synonym: **Chromium trioxide**

CAS RN: 7738945

Formula: CrH_2O_4

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 16).

Monitoring history: **Not included in environmental monitoring program. Included in environmental monitoring program as chromium.**

Environmental fate: **Very soluble in water. Strong oxidizer. See Chromium.**

Toxicity: **Toxicity score, not rated.**

Included on target list(s): No

References: 37, 48, 52, 78

Primary name: Chromium

Synonym:

CAS RN: 7440473

Formula: Cr

Information sources: Not assigned

History of use, production, disposal & quantities: CAR, Section 20 - Nonsource Area (98, p. 8).

Monitoring history: Included in trace metal analysis of water and plants.

Environmental fate: Reacts with dilute HCl and H_2SO_4 but not with HNO_3. Not oxidized by air, even in presence of moisture.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, A (human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 23, 31, 37, 54, 56, 98, 128

Primary Name: Copper

Synonym:

CAS RN: 7440508

Formula: Cu

Information sources: Shell/Army

History of use, production, disposal & quantities: CAR, Section 35 - Uncontaminated (80, p. 14); CAR, Section 20 - Nonsource Area (98, p. 8).

Monitoring history: Included in trace metal analysis of water and plants, and ground-water monitoring programs. Very high concentrations in Basin F, but not found in adjacent wells, probably due to the general insolubility of copper salts in soil. Also found in sampling wells and as a confined pesticide waste product in Basin F. Soil at RMA has high background concentration.

Environmental fate: Solubility in H_2O at 0° C = 7.06×10^5 mg/L $CuCl_2$. Slowly soluble in ammonia, water. Bio-accumulates.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogenic classification, D (not classified).

Included on target list(s): Ground-Water and Soil

References: 2, 3, 4, 9, 23, 25, 31, 35, 54, 56, 80, 98, 128

Primary Name: **Copper sulfate**

Synonym: **Blue vitriol**

CAS RN: 7758987

Formula: $CuSO_4$

Information sources: Shell/Army

History of use, production, disposal & quantities: CAR, Process Water System (91, p. 20).

Monitoring history: No information found.

Environmental fate: Copper will persist in soil, $t_{1/2}$ greater than 5 years. H_2O solubility, 31.6g/100g H_2O (0° C). Solubility greater than 50,000 mg/L. Estimated to be nonvolatile. $T_{1/2}$ 6 months to 1 year.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 10, 27, 31, 52, 91, 128

Primary Name: **Crotoxyphos**

Synonym: Ciodrin insecticide; Dimethyl phosphate of alpha-methyl-benzyl-3- hydroxy-cis-crotonate

CAS RN: 7700176

Formula: $C_{14}H_{19}O_6P$

Assignment: Shell

History of use, production, disposal & quantities: CAR, Site 2-8 (76, p. 13).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Hydrolyzes. Vapor pressure, 1.4×10^{-5} mm at 20° C. Solubility, 1,000 mg/L.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 11, 27, 37, 42, 45, 76, 128

Primary name: **Cyanide**

Synonym:

CAS RN: 57125

Formula: CN

Information sources: Army

History of use, production, disposal & quantities: CAR, North Plants (127, p. 17).

Monitoring history: Included in ground-water programs and Basin F fluid analysis.

Environmental fate: Cyanide has fair mobility in soil. In nonsterile soils, cyanide is readily converted to CO_2 and NH_3.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 21, 31, 58, 127, 128

Primary Name: **Cyanogen chloride**

Synonym: **Chlorine cyanide**

CAS RN: 506774

Formula: CNCl

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 16); CAR, Site 31-7 (120, p. 18).

Monitoring history: Not reported in environmental samples.

Environmental fate: Vapor pressure, 1,000 mm at 20° C. Solubility, 30,000 mg/L. Log octanol/water partition coefficient, 0.64.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 10, 31, 41, 52, 78, 120, 128

Primary Name: 2(1'-Cyano-1'-methyl-ethylamino)-4,6-dichloro-s-triazine

Synonym: 2,4-Dichloro-6-alpha-cyano-alpha-dimethylamino-s-triazine

CAS RN: Not available

Formula: $C_7H_7Cl_2N_5$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Probably not as persistent in the environment as Bladex. Rapidly hydrolyzed to stable acid ($t_{1/2}$ less than 1 month) which is then slowly degraded by microorganisms, $t_{1/2}$ greater than 5 years.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27

Primary Name: **Cyclohexanone**

Synonym:

CAS RN: 108941

Formula: $C_6H_{10}O$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Vapor pressure, 4 mm at 20° C. Solubility, 23,000 mg/L at 20° C. Log octanol/water partition coefficient, 0.81. Relatively easily biodegraded because of ketone group.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 31, 41, 44, 52, 78; 128

Primary name: 2-Cyclohexen-1-one

Synonym: Isophorone

CAS RN: 930687

Formula: $C_9H_{14}O$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Vapor pressure, 0.38 mm at 20° C. Solubillity, 12,000 mg/L. Degraded by microorganisms. $T_{1/2}$ 6 months to 1 year (27), $t_{1/2}$ 1 to 6 months (1).

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 128

Primary Name: 1,3-Cyclopentadiene

Synonym: CPD

CAS RN: 542927

Formula: C_5H_6

Information sources: Shell

History of use, production, disposal & quantities: CAR, Sites 1-13 and 2-18 (73, p. 17); CAR, Site 26-6 (78, p. 17).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Insoluble in H_2O. Rapidly degraded by microorganisms, $t_{1/2}$ less than 1 month. Dimerization (unstable at 70° C), addition likely. Polymerizes to dicyclopentadiene upon standing.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 1, 27, 37, 42, 52, 73, 78, 128

Primary name: D-D soil fumigant

Synonym: 1,3-dichloro-1-propene mixture with 1,2-dichloropropane; Dichloropropenes-dichloropropanes; Nemafere

CAS RN: 8003198

Formula: Mixture of $C_3H_6Cl_2$ and $C_3H_4Cl_2$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 1-10 (71, p. 14).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Decomposition product at high temperature is hydrogen chloride, and phosgene on combustion. Would be detected in purgeable organic gas chromatographic scan.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 44, 45, 71, 128

Primary name: DDE

Synonym: p,p'-Dichlorodiphenyl dichloroethylene; 2,2-bis (p-Chlorophenyl)-1,1-dichloroethylene

CAS RN: 72559

Formula: $C_{14}H_8Cl_4$

Information sources: Lessee prior to Shell

History of use, production, disposal & quantities: Rocky Mountain Arsenal Source Treatment Plan Development Study (25).

Monitoring history: Found in Section 36, soils 0 to 7 ft depth.

Environmental fate: Solubility, 0.040 mg/L. DDE is the first decomposition product of DDT in soil. Resistant to biodegradation. Log octanol/water partition coefficient 4.28 and 5.69.

Toxicity: Toxicity score, 2. (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-water and Soil

References: 9, 25, 31, 41, 54, 55, 128

Primary name: DDT

Synonym: p,p-Dichlorodiphenyltrichloroethane

CAS RN: 50293

Formula: $C_{14}H_9Cl_5$

Information sources: Lessee prior to Shell

History of use, production, disposal & quantities: CAR, Sites 1-13 and 2-18 (73, p. 8); CAR, Site 3-4 (85, p. 14); CAR, Sanitary Sewer - South Plants (89, p. 13); CAR, Section 6 - Nonsource Area (115, p. 19); CAR, Section 12 - Uncontaminated Area (118, p. 14); CAR, North Plants (127, p. 17).

Monitoring history: Included in soil and ground-water monitoring program at the arsenal and detected in samples. Found in Section 36, generally in vicinity of lime pits.

Environmental fate: Included in analysis of water, soil and waste. Persistent in soil. Solubility 0.006 mg/L at 25° C. Log octanol/water partition coefficient 6.19 at 20° C.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 21, 31, 36, 54, 55, 73, 85, 89, 115, 118, 127, 128

Primary Name: DDVP

Synonym: Phosphoric acid, 2,2-dichlorovinyl dimethyl ester; Vapona insecticide; Dichlorovos; Dimethyl dichlorovinyl phosphate

CAS RN: 62737

Formula: $C_4H_7Cl_2O_4P$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: $T_{1/2}$ (saturated solution) approximately 17 days; hydrolysis very rapid in the presence of alkali, slower in acidic, solutions. Thermally stable. Solubility is approximately 1% by weight. Vapor pressure, 1.2×10^{-2} mm at 20^{o} C.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): Soil

References: 1, 11, 27, 29, 31, 41, 42, 128

Primary Name: 1,2-Dibromo-3-chloropropane

Synonym: DBCP; Nemagon

CAS RN: 96128

Formula: $C_3H_5Br_2Cl$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 3-4 (85, pp. 12-13); CAR, Site 24-6 (86, p. 13); CAR, Sanitary Sewer Interception Line (88, p. 9); CAR, Sanitary Sewer - South Plants (89, p. 18); CAR, Section 33 - Nonsource Area (124, p. 12).

Monitoring history: DBCP plume extends approximately two miles northwest of the railyard, Section 3.

Environmental fate: Stable in neutral and basic media. Reacts with dilute inorganic bases. Hydrolyzed under basic conditions to 2-bromoallyl alcohol. Does not persist in soil to extent that it forms an accumulation problem. Light can cause free redical elimination to form chloro and bromo olefins. $T_{1/2}$ 6 months to 1 year. Vapor pressure, 0.8 mm at 21° C. Solubility, 1,000 mg/L at room temperature.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-water and Soil

References: 1, 11, 27, 31, 33, 41, 42, 43, 54, 55, 85, 86, 88, 89, 124, 128

Primary name: **Dibromodichloroethene**

Synonym:

CAS RN: Not available

Formula: $C_2Cl_2Br_2$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Estimated solubility ranges from 1 to 1,000 mg/L. Slightly volatile.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary name: 1,1 Dibromoethane

Synonym: Ethylidene dibromide

CAS RN: 557915

Formula: $C_2H_4Br_2$

Information sources: Not assigned

History of use, production, disposal & quantities:
Correspondence re: RMA Litigation (48).

Monitoring history: No information found.

Environmental fate: Soluble in about 250 parts water. Vapor harmful. Vapor pressure 17.4 mm/ at 30° C. When heated to decomposition, emits toxic fumes of Br_2.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 37, 48, 128

Primary name: 2,6-di-tert-butyl-p-cresol

Synonym: Ionol; Ionol flaking; Flaked ionol; Ionol antioxidant flaking; Ionol crystalline; Butylated hydroxytoluene

CAS RN: 128370

Formula: $C_{15}H_{24}O$

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #13 (46).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Solubility, 0.4 mg/L at 20° C. Biodegradation possible.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 37, 46, 128

Primary name: 2,2-dichloroacetaldehyde

Synonym:

CAS RN: 79027

Formula: $C_2H_2Cl_2O$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Soil $t_{1/2}$ 1 month.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary name: 2,2-Dichloroacetoacetic acid

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Estimated solubility,greater than 50,000 mg/L. Slightly volatile. Microbially degraded, $t_{1/2}$ 1 month.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary name: **p-Dichlorobenzene**

Synonym: 1,4-Dichlorobenzene

CAS RN: 106467

Formula: $C_6H_4Cl_2$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Process Water System (91, p. 26).

Monitoring history: No information found.

Environmental fate: Solubillity, 49 mg/L at 22° C. Stable. Degraded by microorganisms, $t_{1/2}$ 6 months to 1 year. Vapor pressure, 0.6 mm at 20° C. Log octanol/water partition coefficient, 3.39 at 20° C.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 41, 91, 128

Primary Name: 2,2-Dichloro-1-(2,4-dichlorophenyl)-ethanone

Synonym: 2,2,2',4'-Tetrachloroacetophenone

CAS RN: 2274660

Formula: $C_8H_4Cl_4O$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Stable, slow degradation by micro-organisms.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27

Primary Name: 1,1-Dichloroethane

Synonym: Ethylidene dichloride

CAS RN: 75343

Formula: $C_2H_4CL_2$

Information sources: Army/Lessee

History of use, production, disposal & quantities: HCIC Report: Literature Reviews on 54 RMA On-Post Contaminants (30).

Monitoring History: Included in the soil and ground-water monitoring programs.

Environmental fate: When heated to decomposition, it emits highly toxic phosgene fumes. Can react vigorously with oxidizing materials. Solubility, 5,500 mg/L at 20° C. Vapor pressure, 180 mm at 20° C.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, D (not classified).

Included on target list(s): Ground-Water and Soil

References: 30, 31, 36, 37, 41, 54, 57, 128

Primary name: 1,2-Dichloroethane

Synonym:

CAS RN: 107062

Formula: $C_2H_4Cl_2$

Information sources: Not assigned

History of use, production, disposal & quantities: History of Pollution Sources and Hazards at RMA (10).

Monitoring history: Included in environmental monitoring program.

Environmental fate: Vapor pressure, 61 mm at 20° C. Solubility, 8,690 mg/L at 20° C.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 10, 31, 37, 54, 55, 128

Primary Name: 1,1-Dichloroethylene

Synonym: Vinylidene chloride

CAS RN: 75354

Formula $C_2H_2Cl_2$

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring History: Included in soil and ground-water monitoring programs.

Environmental fate: When heated to decomposition, emits highly toxic fumes of chloride ions. Liquid. Vapor pressure, 591 mm at 25° C. Gradually decomposed by air, light, and moisture to form HCl. Somewhat persistent.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogenic classification, C (possible human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 31, 37, 41, 54, 55, 128

Primary name: 1,2-Dichloroethylene

Synonym: cis-dichloroethylene

CAS RN: 156592

Formula: $C_2H_2Cl_2$

Information sources: Army/Lessee

History of use, production, disposal & quantities: HCIC Report: Literature Reviews on 54 RMA On-Post Contaminants (30).

Monitoring history: Included in soil and ground-water monitoring programs.

Environmental fate: When heated to decomposition, emits highly toxic fumes of chloride ions. Liquid. Gradually decomposed by air, light, and moisture to form HCl. Vapor pressure, 200 mm at 25° C (cis) and 200 mm at 14° C (trans). Aqueous solubility 800 mg/L at 20° C (cis), 600 mg/L at 20° C (trans). Somewhat persistent.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, D (not classified).

Included on target list(s): Ground-water and Soil

References: 30, 31, 33, 37, 41, 54, 56, 128

Primary name: 3,4-Dichloro-5-nitrophenyl methyl sulfone

Synonym: SD 14011

CAS RN: Not available

Formula: Not available

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #15 (44).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 42, 44

Primary name: 1,2-Dichloropropane

Synonym:

CAS RN: 78875

Formula: $C_3H_6Cl_2$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 1-10 (71, p. 12); CAR, Sites 1-13 and 2-18 (73, p. 9).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Vapor pressure, 42 mm at 20° C. Solubility in water at 20° C, 2,700 mg/L. Would be detected in a purgeable organic gas chromatographic scan. Log octanol/water partition coefficient 2.43.

Tocicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 41, 71, 73, 128

Primary name: cis-1,3-Dichloropropene

Synonym: 1,3-Dichloro-1-propene

CAS RN: 10061015

Formula: $C_3H_4Cl_2$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 1-10 (71, p. 12); CAR, Sites 1-13 and 2-18 (73, p. 9).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Vapor pressure, 43 mm at 25° C. Solubility, 2,700 mg/L. Would be detected in a purgeable organic gas chromatographic scan.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 31, 41, 71, 73, 128

Primary name: **Dicrotophos**

Synonym: **Bidrin insecticide; 2-dimethylcis 2-dimethyl-carbamoyl-1-methylvinyl phosphate**

CAS RN: **141662 (trans-Bidrin); 18250630 (cis-Bidrin)**

Formula: $C_8H_{16}NO_5P$

Information sources: **Shell**

History of use, production, disposal & quantities: **CAR, Site 2-8 (76, p. 13).**

Monitoring history: **No information found.**

Environmental fate: **Bidrin is unstable in soil. $T_{1/2}$ in H_2O, at 37° C, pH 9 50 days; at pH 1 100 days. Aqueous solubility, greater than 50,000 mg/L.**

Toxicity: **Toxicity score, 4 (RTECS).**

Included on target list(s): **No**

References: **1, 27, 42, 45, 76, 128**

Primary name: Dicyclopentadiene

Synonym: 3a,4,7,7a-Tetrahydro-4,7-methanoindene; Bicyclopentadiene; DCPD

CAS RN: 77736

Formula: $C_{10}H_{12}$

Information Sources: Shell

History of use, production, disposal & quantities: CAR, Site 1-10 (71, p. 11); CAR, Sites 1-13 and 2-18 (73, pp. 10, 11); CAR, Site 26-6 (78, p. 17); CAR, Site 2-1 (82, p. 11); CAR, Site 24-7 (87, p. 18).

Monitoring history: Detected in soil and water samples. There is material originating from the southeast corner of Basin F.

Environmental fate: Insoluble in water. Oxidizes (to epoxide?), rate increasing rapidly with temperature. Depolymerizes at elevated temperatures. Possibly converted by microorganisms ($t_{1/2}$ 1 month to 1 year) to a stable epoxide having $t_{1/2}$ greater than 5 years. Vapor Pressure 10 mm at 47.6° C.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): Ground-Water and Soil.

References: 1, 4, 7, 9, 27, 31, 41, 42, 52, 71, 73, 78, 82, 87

Primary name: **Dieldrin**

Synonym: **Hexachloroepoxyoctahydro-endo, exo-dimetha-nonaphthalene; Compound 497**

CAS RN: **60571**

Formula: $C_{12}H_8Cl_6O$

Information sources: **Shell**

History of use, production, disposal & quantities: **CAR, Site 36-7 (63, p. 12); CAR, Site 36-17 (66, p. 67); CAR, Site 1-11 (72, p. 19); CAR, Sites 1-13 and 2-18 (73, p. 8); CAR, Site 26-6 (78, p. 17); CAR, Site 2-1 (82, p. 11); CAR, Site 2-17 (83, p. 14).**

Monitoring history: **Significant localized contamination in Section 36. Detected in soil and water samples.**

Environmental fate: **Decomposition product of Aldrin. Stable in water to bases and dilute acids. Very persistent in soils, $t_{1/2}$ 7 years. Stable to normal temperatures in the environment. Stable to light. Solubility 0.1 mg/L. Hydrolysis is slow. Moderate bioaccumulation.**

Toxicity: Toxicity score, 4 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 1, 3, 9, 11, 27, 31, 35, 41, 42, 54, 55, 63, 66, 72, 73, 78, 82, 83, 128

Primary name: **Diethyldimethyldiphosphonate**

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: Presence unlikely - VX spilled only once and decontaminated promptly.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 2

Primary name: O,O-Diethylphosphorochloridothioate

Synonym: Diethyl chlorothiophosphate; Ethyl thio acid chloride; Ethyl TAC

CAS RN: 2524041

Formula: $C_4H_{10}ClO_2PS$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Hydrolyzed. Degraded by microorganisms, $t_{1/2}$ less than 6 months. Insoluble.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 128

Primary name: O,O-Diethyl thionophosphonate

Synonym:

CAS RN: Not available

Formula: $C_4H_{11}O_3PS$

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #15 (44).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 42, 44

Primary name: 2,4-Dihydroxy-2-methyl pentane

Synonym: 2-Methyl-2,4-pentanediol; Hexylene glycol

CAS RN: 107415

Formula: $C_6H_{14}O_2$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Solubility, greater than 50,000 mg/L. Vapor pressure, 0.06 mm at 20° C. Rapidly biodegraded, $t_{1/2}$ less than 1 month. Log octanol/water partition coefficient, 0.14.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 27, 41, 128

Primary name: S-Diisopropylaminoethyl-methylphosphonothioate

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: Presence unlikely - VX spilled only once and promptly decontaminated.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 2

Primary Name: **2-(Diisopropylamino)-n-ethyl sulfonate**

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: Compound possible decomposition product of VX; Military Chemistry and Chemical Agents (32).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No.

References: 32

Primary name: **Diisopropyldimethyl diphosphonate**

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: Presence unlikely due to special and reversible conditions involved in its formation.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 2

Primary name: N,N-Diisopropylethanolamine

Synonym: 2-Diisopropylaminoethanol

CAS RN: 96800

Formula: $C_8H_{19}NO$

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: Presence unlikely - VX spilled only once and promptly decontaminated.

Environmental fate: Not documented.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 2, 31, 128

Primary Name: Diisopropyl methyl phosphonate

Synonym: DIMP; Phosphonic acid, methyl-bis (1-methylethyl) ester

CAS RN: 1445756

Formula: $C_7H_{17}O_3P$

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 35-4 (79, p. A-4); CAR, Site 24-7 (87, p. 18).

Monitoring history: DIMP plume eminating from Basin A, Basin A neck. Primary center of mass of the DIMP plume is in the area of wells 11,780 and CP104 (actual well location not specified). CDH performed assays of ground water at an alleged damaged area in 1974 and detected DIMP 2.75 miles downstream of Basin A. Further testing of RMA wells (8/75) revealed the highest concentration being just downstream from Basin A. Although DIMP has not been added to Basin F since the early 1960s, as of 1975, there was still a high concentration of DIMP. DIMP concentration was found at Section 14 (off-site). The DIMP plume extends 10 miles north of RMA.

Environmental fate: Solubility, 1,500 mg/L at 25° C. Hydrolysis at 10° C. $T_{1/2}$ is approximately 530 years.

Toxicity: Toxicity score, 2 (Hart, 1976).

Included on target list(s): Ground-Water and Soil

References: 2, 3, 4, 7, 9, 25, 31, 79, 87, 130

Primary Name: Dimethanonaphthalene

Synonym:

CAS RN: Not available

Formula: $C_{12}H_{14}$

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #15 (44).

Monitoring History: Not included in environmental monitoring program.

Environmental fate: Low mobility in soil and ground water.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 42, 44

Primary Name: N,N-Dimethylacetoacetamide

Synonym: Butanamide, N,N-dimethyl-3-oxo

CAS RN: 2044646

Formula: $C_6H_{11}NO_2$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27); Denver Plant Waste Disposal Survey (42).

Monitoring History: No information found.

Environmental fate: Hydrolyzed. Degraded by microorganisms, $t_{1/2}$ 6 months. Estimated solubility, greater than 50,000 mg/L.

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): No.

References: 1, 27, 31, 42, 128

Primary name: **Dimethyl arsenic acid**

Synonym: **Cacodylic acid; Hydroxydimethylarsine oxide**

CAS RN: 75605

Formula: $C_2H_7AsO_2$

Information sources: **Not assigned.**

History of use, production, disposal & quantities: Compound possibly related to lewisite manufacture. Generally used as a herbicide.

Monitoring history: **Not included in environmental monitoring.**

Environmental fate: **Solubility, 2,000 g/L at 25° C.**

Toxicity: **Toxicity score, 2 (RTECS). EPA carcinogenic classification, D (not classified).**

Included on target list(s): **No**

References: **31, 37, 41, 54, 55, 128**

Primary Name: **Dimethylchloroacetoacetamide**

Synonym: 2-Chloro-N,N-dimethylacetoacetamide; DMCAA; Butanamide,2-chloro-N,N-dimethyl-3-oxo

CAS RN: 5810117

Formula: $C_6H_{10}ClNO_2$

Information sources: Shell

History of use, production, disposal and quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Hydrolyzed. Degraded by microorganisms, $t_{1/2}$ 1 to 6 months. Solubility, greater than 50,000 mg/L.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27

Primary Name: N,N-Dimethyl-2,2-dichloroacetoacetamide

Synonym: DMACC

CAS RN: 22543266

Formula: $C_6H_9Cl_2NO_2$

Information sources: Shell

History of use, production, disposal and quantities: Shell Response to US Interrogatory #15 (44).

Monitoring history: No information found.

Environmental fate: Structure is consistent with relatively easy biodegradability and high aqueous solubility.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 42, 44

Primary Name: **Dimethyldisulfide**

Synonym: **Methyl disulfide**

Formula: $C_2H_6S_2$

CAS RN: 624920

Information sources: **Shell**

History of use, production, disposal and quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: **Included in soil and ground-water monitoring programs.**

Environmental fate: **Can react vigorously with oxidizing materials. Liquid. Solubility, 350 mg/L. Microbiological degradation - probably rapidly degraded.**

Toxicity: **Toxicity score, 3 (Ato Chem, 1986).**

Included on target list(s): **Ground-Water and Soil**

References: **30, 31, 41, 44, 46, 78, 131**

Primary Name: 1,1-Dimethylhydrazine

Synonym: Unsymmetrical dimethylhydrazine; UDMH

CAS RN: 57147

Formula: $C_2H_8N_2$

Information sources: Army

History of use, production, disposal & quantities: CAR, Section 36 - Nonsource Area (67, p. 11); CAR, Site 36-19 (112, p. 9).

Monitoring history: No information found.

Environmental fate: UDMH is volatile and rapidly decomposes. Some conversion to N-nitrosodimethylamine in the environment. Vapor pressure, 157 mm at 25° C.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): Soil

References: 10, 31, 41, 52, 67, 112, 128

Primary name: **Dimethylmercury salts**

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Not assigned

History of use, production, disposal & quantities: Compound possibly related to Lewisite manufacture. HCIC Report: Literature Reviews on 54 RMA On-Post Contaminants (30).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Bacteria can methylate or dimethylate Hg^{+2} from suspected Army precursor $HgCl_2$; most likely to occur in saturated sediment.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 2, 30, 31

Primary Name: Dimethyl methylphosphonate

Synonym: DMMP

CAS RN: 756796

Formula: $C_3H_9O_3P$

Information sources: Army/Shell

History of use, production, disposal & quantities:
Decontamination Technology Research & Development Program for Installation Restoration at RMA (14); Denver Plant Waste Disposal Survey (42).

Monitoring history: Included in environmental monitoring programs for soil and ground water.

Environmental fate: No information located.

Toxicity: Toxicity score, 3 (Hollinghaus, et al, 1981).

Included on target list(s): Ground-Water and Soil

References: 8, 14, 42, 53, 132

Primary Name: Dimethylnitrosamine

Synonym: N-Nitrosodimethylamine; DMNA

CAS RN: 62759

Formula: $C_2H_6N_2O$

Information sources: Army

History of use, production, disposal & quantities:
Degradation product of hydrazine. CAR, Site 1-7 (92, p. 13).

Monitoring history: Detected in recent monitoring of hydrazine plant area as a degradation product in soil.

Environmental fate: Oxidation product of 1,1-Dimethyl-hydrazine. Soluble in H_2O, alcohol and ether.

Toxicity: Toxicity score, 4 (RTECS). EPA carcinogenic classification, B1 (probable human carcinogen).

Included on target list(s): Soil

References: RMA, Task 2, Fieldwork. Personal communication with Kevin Blose; 31, 54, 55, 92, 128

Primary Name: **Dimethyl phosphate**

Synonym: DMP; Phosphoric acid, dimethyl ester

CAS RN: 813785

Formula: $C_2H_7PO_4$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Monitored as phosphate.

Environmental fate: Very stable, slowly hydrolyzed to phosphoric acid. Rapidly degraded in environment by microorganisms, $t_{1/2}$ less than 1 month.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27

Primary Name: O,O-Dimethylphosphorochloridothioate

Synonym: TAC; Dimethyl chlorothiophosphate

CAS RN: 2524030

Formula: $C_2H_6ClO_2PS$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Hydrolyzed. Degraded by microorganisms, $t_{1/2}$ less than 6 months. Insoluble.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 1, 12, 27, 31, 128

Primary Name: 1,3-Dimethylurea

Synonym: Dimethylurea; DMU

CAS RN: 96311

Formula: $C_3H_8N_2O$

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #15 (44).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Water and alcohol soluble. Dimethyl urea hydrolyzes rapidly in soil as soil microorganisms produce exogenous ureases.

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): No

References: 31, 44, 128

Primary Name: **Dipiperazine**

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 1-7 (92, p. 13).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 43, 92

Primary Name: **Dipropylamine**

Synonym: **Di-n-propylamine**

CAS RN: 142847

Formula: $C_6H_{15}N$

Information sources: **Shell**

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: **No information found.**

Environmental fate: **Stable. Rapidly degraded by microorganisms, $t_{1/2}$ less than 1 month. Vapor pressure, 30 mm at 25° C. Log octanol/water partition coefficient, 1.73.**

Toxicity: **Toxicity score, 3 (RTECS).**

Included on target list(s): **No**

References: **1, 27, 31, 41, 42, 52, 78, 128**

Primary name: **Di-n-propylnitrosamine**

Synonym: N-Nitroso-N-propyl-1-propanamine; N-Nitrosodi-n-propylamine

CAS RN: 621647

Formula: $C_6H_{14}N_2O$

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring history: Not included in monitoring programs.

Environmental fate: Resists oxidation, hydrolysis and microbial degradation.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): Soil

References: 58, 128

Primary Name: 1,4-Dithiane

Synonym: DITH

CAS RN: 505293

Formula: $C_4H_8S_2$

Information sources: Army

History of use, production, disposal & quantities: Assessment of Contaminant Migration from Potential Contamination Sources (3).

Monitoring history: A plume of ground-water contamination in Section 36 (Basin A) has been reported.

Environmental fate: Present as a soil contaminant also. Solubility, 3,000 mg/L at 25° C.

Toxicity: Toxicity score, 2 (Mayhew and Muni, 1986).

Included on target list(s): Ground-Water and Soil

References: 3, 7, 30, 31, 34, 133

Primary Name: **Endrin**

Synonym: 2,7:3,6-Dimethanonapth [2,3-b]oxirene, 3,4,5, 6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-oxtahydro,endo endo; 269

CAS RN: 72208

Formula: $C_{12}H_8Cl_6O$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 36-7 (63, p. 12); CAR, Site 26-6 (78, p. 17).

Monitoring history: High concentrations occuring in the vicinity of tha lime pits (27). 1952 to 1970, recorded spill in Section 1, (leaking sewer line) (29).

Environmental fate: Stable in H_2O to ordinary bases. $T_{1/2}$ in soils 4 to 8 years. Rapidly transformed by sunlight to form a ketone. Nearly insoluble in H_2O. Solubility, less than or equal to 1 mg/L. Vapor pressure, 2×10^{-7} mm at 25° C.

Toxicity: Toxicity score, 4 (RTECS). EPA carcinogenic classification, E (evidence of noncarcinogenicity).

Included on target list(s): Ground-Water and Soil

References: 1, 3, 9, 11, 27, 29, 31, 41, 42, 52, 54, 56, 63, 78, 128

Primary Name: **Ethanamine**

Synonym: Aminoethane; Ethylamine

CAS RN: 75047

Formula: C_2H_7N

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Miscible with H_2O. Stable. Reacts violently with oxidizing materials. Rapidly degraded by microorganisms, $t_{1/2}$ less than 1 month. Vapor pressure, 1.2 atm at 20° C. Solubility greater than 50,000 mg/L. Log octanol/water partition coefficient, -0.27/-0.08.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 41, 42, 128

Primary name: **Ethyl benzene**

Synonym:

CAS RN: 100414

Formula: C_8H_{10}

Information sources: Not assigned

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: $T_{1/2}$ less than one month. Vapor pressure, 7 mm at 20° C. Solubility, 152 mg/L at 20° C. Slightly soluble. Component of leaded and unleaded gasoline. Biodegradation - somewhat persistent. Log octanol/water partition 3.15.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, D (not classified).

References: 27, 31, 33, 41, 54, 56, 128

Primary Name: **Ethyl methyl phosphonate**

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: Presence unlikely - VX spilled only once and promptly decontaminated.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 2, 14

Primary Name: O-Ethyl methylphosphonothioate

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: Presence unlikely - VX spilled only once and decontaminated promptly.

Environmental fate: Not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 2, 14

Primary Name: Ethyl parathion

Synonym: Diethyl p-nitrophenol thiophosphate; Phosphonothioic acid, o,o-diethyl o-(4-nitrophenyl) ester; Parathion

CAS RN: 56382

Formula: $C_{10}H_{14}NO_5PS$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Analyte in 1976, 360° ground-water monitoring program; detected Well #133.

Environmental fate: $T_{1/2}$ in H_2O 150 days (pH 10); pH less than or equal to 7, very slow hydrolysis; pH 5-6, 1% loss in 62 days (25° C). Solubility, 24 mg/L. Vapor pressure, 0.003 mm at 24° C. Log octanol/water partition coefficient, 3.81.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 1, 11, 12, 21, 25, 27, 31, 41, 128

Primary Name: **Fluoride**

Synonym:

CSA RN: 16984488

Formula: F

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 2-8 (76, p. 12).

Monitoring history: Monitored in soil and ground water. Fluoride is a contaminant in ground water flowing toward North Boundary. The background level of fluoride is high at RMA. Well #105 on the Northwestern Boundary has consistently high fluoride levels. Twenty four samples of water taken from wells in RMA had fluoride concentrations in appreciable excess of the limit (24).

Environmental fate: Not documented, see specific salts.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): Ground-Water and Soil

References: 3, 24, 25, 34, 76, 128

Primary name: **Fenvalerate**

Chemical name: Cyano(3-phenoxyphenyl)methyl-4-chloro-alpha(1-methyl ethyl); Pydrin insecticide

CAS RN: 51630581

Formula: $C_{25}H_{22}O_3ClN$

Information sources: Shell

History of use, production, disposal & quantities: History of Pollution Sources and Hazards at RMA (10).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Solubility, 0.085 mg/L at room temperature. Log octanol/water partition coefficient, 4.42.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 10, 31, 41, 128

Primary name: **Fluoroacetic acid**

Synonym: Fluoroethanoic acid

CAS RN: 144490

Formula: $C_2H_3FO_2$

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring history: No information located.

Environmental fate: Colorless solid, water soluble. When heated to decomposition emits toxic fumes of F^-. Soluble in water.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 31, 37, 128

Primary name: Fluoranthene

Synonym: 1,2-(1,8-Naphthylene)benzene

CAS RN: 206440

Formula: $C_{16}H_{10}$

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring history: Tentatively identified as nontarget analyte in RI soil program.

Environmental fate: A polynuclear aromatic hydrocarbon (PNA). Resistant to microbial degradation. Solubility, 0.265 mg/L at 25° C.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 41, 59, 128

Primary Name: **Formaldehyde**

Synonym:

CAS RN: 50000

Formula: CH_2O

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 1-7 (92, p. 13).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Easily decomposed in soil. Log octanol/water partition coefficient, 0.07.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 10, 41, 92, 128

Primary Name: **Freon 113**

Synonym: 1,1,2-Trichloro-1,2,2-trifluoroethane

CSA RN: 76131

Formula: $C_2F_3Cl_3$

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 2-14b (77, p. 9); CAR, Site 26-6 (78, p. 17).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Vapor pressure, 270 mm at 20° C.

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): No

References: 10, 31, 52, 77, 78, 128

Primary Name: **Fuel Oil #6**

Synonym:

CSA RN: 68553004

Formula: Not available, mixture of hydrocarbons

Information sources: Army/Shell

History of use, production, disposal & quantities: History of Pollution Sources and Hazards at RMA (10).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Composed of many aliphatic and aromatic hydrocarbons; see hydrocarbon entries.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 10, 29, 31, 53

Primary name: **Gardona**

Synonym: **Phosphoric acid, 2-chloro-1-(2,4,5-trichlorophenyl) ethenyl dimethyl ester, [(z)]**

CAS RN: 22248799

Formula: $C_{10}H_9Cl_4O_4P$

Information sources: **Shell**

History of use, production, disposal & quantities: **Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).**

Monitoring history: **Not included in environmental monitoring program.**

Environmental fate: **Hydrolysis $T_{1/2}$ in H_2O (38° C), 37 hours at pH 9 and 7,200 hours at pH 1.1. $T_{1/2}$ in H_2O (50° C), 1,300 hours at pH 3 and 1,060 hours at pH 7 and 80 hours at pH 10.5. Rapid breakdown in soils. Solubility from 1 to 1,000 mg/L. $T_{1/2}$ in soil, less than 1 month (27).**

Toxicity: **Toxicity score, 3 (RTECS).**

Included on target list(s): **No**

References: **1, 11, 27, 128**

Primary name: Gear oil additive 399

Synonym:

CAS RN: Not available

Formula: Not available, proprietary product with no formula disclosed.

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #13 (46).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 46

Primary name: **Glyceryl mono-oleate**

Synonym: **9-Octadecenoic acid (Z)-,monoester with 1,2,3-propametriol**

CAS RN: **25496724**

Formula: $C_{21}H_{40}O_4$

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #15 (44).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented. Chemical characteristics of compounds are consistent with biodegradability.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 42, 44

Primary name: **GOOP (Mg dust, oil/asphalt)**

Synonym:

CAS RN: Not available

Formula: A paste composed of magnesium carbide, powdered carbide, and oil.

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 38); CAR, Site 2-2 (74, p. 9); CAR, Site 36-2 (107, p. 10).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 10, 66, 74, 107

Primary name: HCCPD impurities

Synonym:

CAS RN: 59808785 (Tetrachlorocyclopentane)

Formula: Consists primarily of tetrachlorocyclopentane ($C_5H_6Cl_4$)

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatory #15 (44).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented. Chemical characteristics are consistent with resistance to biodegradation.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 42, 44

Primary name: **Heptachlor**

Synonym: 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene

CAS RN: 76448

Formula: $C_{10}H_5Cl_7$

Information sources: Lessee prior to Shell.

History of use, production, disposal & quantities: CAR, Site 31-7 (120, p. 18).

Monitoring history: Areally heptachlor is limited to lime pits. Ground-water monitoring showed no evidence of migration.

Environmental fate: Converted in soils to heptachlor epoxide and hydroxychlordene, $t_{1/2}$ = 2-4 yrs, $t_{1/2}$ in Congaree sandy loam about 8 yrs. Biodegradation - highly persistent. Solubility in H_2O at 25°C is 0.056 mg/L.

Toxicity: Toxicity score, 4 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): No

References: 1, 25, 27, 31, 33, 35, 54, 55, 120, 128

Primary name: **Heptachlor epoxide**

Synonym: 2,5-Methano-2H-indeno[1,2-b]oxirene,2,3,4,5,6,7,7-heptachloro-1a,1b,5,5a,6,6a-hexahydro-, (1a.alpha., 1b.beta., 2.alpha., 5.alpha., 5a.beta., 6.beta., 6a.alpha.)

CAS RN: 1024573

Formula: $C_{10}H_5Cl_7O$

Information sources: Lessee prior to Shell

History of use, production, disposal & quantities:
Degradation product of heptachlor. Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Found in the vicinity of lime pits. Ground-water monitoring showed no evidence of migration.

Environmental fate: Stable in soils, $t_{1/2}$ approximately 4 years and $t_{1/2}$ in sandy loam is approximately 1 year. Degrades to less toxic 1-exo-hydroxychlordene. Stable in H_2O. Solubility approximately 1 mg/L. Biodegradation - highly persistent. Hydrolysis is slow.

Toxicity: Toxicity score, 4 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): No

References: 1, 25, 27, 31, 33, 35, 41, 54, 55, 128

Primary name: **Heptachlorobicycloheptene**

Synonym: 2-Norbornene, 1,2,3,4,5,7,7- heptachloro; Compound 773

CAS RN: 5202368

Formula: $C_7H_3Cl_7$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: No information found.

Environmental fate: Stable. Slow degradation by microorganisms, $t_{1/2}$ 1 to 5 yrs.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27, 42, 78

Primary name: **Heptane**

Synonym:

CAS RN: 142825

Formula: C_7H_{16}

Information sources: Tentatively assigned to Shell as reported in reference 11.

History of use, production, disposal & quantities: CAR, Sites 1-13 and 2-18 (73, p. 8); CAR, Sites 26-6 (78, p. 17).

Monitoring history: Heptane not detected.

Environmental fate: Vapor pressure, 35 mm at 20° C. Solubility, 3 mg/L at 20° C.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 11, 29, 31, 41, 42, 73, 78

Primary name: **Hexachlorobenzene**

Synonym: HCB

CAS RN: 118741

Formula: C_6Cl_6

Information sources: Not assigned

History of use, production, disposal & quantities: No reported use, not present in waste streams.

Monitoring history: Included as analyte in monitoring program, HCB not detected. Tentatively identified as nontarget analyte in soil RI program.

Environmental fate: Very persistent in soils, sediments, and aquatic system. Resistant to microbial degradation. Vapor pressure, 1.089×10^{-5} mm. Solubility, 0.11 mg/L at 24° C. Log octanol/water partition coefficient, 6.18.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 13, 31, 41, 59, 128

Primary name: 1,2,3,4,7,7-Hexachlorobicyclo(2.2.1)hepta-2,5-diene

Synonym: Hexachloronorbornadiene; 601

CAS RN: 3389717

Formula: $C_7H_2Cl_6$

Information sources: Shell

History of use, production, disposal & quantities: Handbook of Environmental Data on Organic Chemicals.

Monitoring history: Analytical parameter for ground-water study done by Shell, on Shell's leasehold (13). Listed as potential contaminant at RMA (14). Included in synthetic waste study done by Calgon for RMA (28).

Environmental fate: Water solubility, 10 to 30 mg/L.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 13, 14, 28, 41

Primary name: **Hexachlorobutadiene**

Synonym: **Perchlorobutadiene; HCBD; C-46**

CAS RN: 87683

Formula: C_4Cl_6

Information sources: **Not assigned**

History of use, production, disposal & quantities: **No reported use or production.**

Monitoring history: **Used as analytical parameter in ground-water study done by Shell, at South Plants area (13). Included in synthetic waste study done by Calgon for RMA (28). Monitored for, but not detected. Tentatively identified as nontarget analyte in both the soil and ground-water RI programs.**

Environmental fate: **Persistence in soil is greater than or equal to 3 years. Half life in ground water is between 30 and 300 days. Solubility, 2 mg/L. Vapor pressure, 22 mm at 100°C.**

Toxicity: **Toxicity score, 3 (RTECS).**

Included on target list(s): **No**

References: **13, 28, 31, 59, 128**

Primary name: **Hexachlorocyclopentadiene**

Synonym: **Hex**

CAS RN: 77474

Formula: C_5Cl_6

Information sources: Shell

History of use, production, disposal & quantities: CAR, Sites 1-13 and 2-18 (73, p. 14); CAR, Site 26-6 (78, p. 17); CAR, Site 2-1 (82, p. 11).

Monitoring history: No information found.

Environmental fate: Very slightly soluble in water. Stable. Slow biodecomposition, $T_{1/2}$ in soil 6 months to 2 years. Bioaccumulates.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogenic classification, D (not classified).

Included on target list(s): Ground-Water and Soil

References: 1, 27, 29, 31, 35, 42, 54, 57, 73, 78, 82, 128

Primary Name: 4,5,6,7,8,8-Hexachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene

Synonym: Chlordene

CAS RN: 3734483

Formula: $C_{10}H_6Cl_6$

Information sources: Lessee prior to Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Very slightly water soluble, chemically similar to chlordane. Resistant to decomposition, $t_{1/2}$ in soil greater than 5 yrs.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 27, 128

Primary name: **n-Hexane**

Synonym:

CAS RN: 110543

Formula: C_6H_{14}

Information sources: Shell

History of use, production, disposal & quantities: CAR, Sites 1-13 and 2-18 (73, p. 18); CAR, Site 26-6 (78, p. 17).

Monitoring history: No information found.

Environmental fate: Aqueous solubility, 13 mg/L. Rapidly degraded by soil microorganisms, $t_{1/2}$ less than 1 month. Vapor pressure, 120 mm at 20° C.

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): No

References: 1, 29, 31, 41, 42, 73, 78, 128

Primary name: **Hexone**

Synonym: 4-Methyl-2-pentanone; Methyl isobutyl ketone; MIBK

CAS RN: 108101

Formula: $C_6H_{12}O$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Sites 1-13 and 2-18 (73, p. 20); CAR, Site 26-6 (78, p. 17).

Monitoring history: No information found.

Environmental fate: Degraded by microorganisms, $t_{1/2}$ less than 6 months. Vapor pressure, 6 mm at 20° C. Solubility, 17,000 mg/L.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): Ground-Water and Soil

References: 1, 27, 31, 42, 73, 78, 128

Primary name: Hydrazine

Synonym:

CAS RN: 302012

Formula: N_2H_2

Information sources: Army

History of use, production, disposal & quantities: CAR, Section 36 - Nonsource Area (67, p. 11); CAR, Site 26-6 (78, p. 16); CAR, Site 24-6 (86, p. 14); CAR, Site 1-7 (92, pp. 12, 13); CAR, Site 36-19 (112, p. 9); CAR, Army Spill Sites (125, p. 26); CAR, Hydrazine Blending and Storage Facility (126, pp. 1-7).

Monitoring history: Included in environmental monitoring program in areas of suspected contamination.

Environmental fate: Vapor pressure, 16 mm at 20° C. In soil quickly oxidizes, biochemically, to nitrate. Log octanol/water partition coefficient, -1.37/-0.60.

Toxicity: Toxicity score, 4 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Soil

References: 10, 31, 41, 52, 54, 55, 67, 78, 86, 92, 112, 125, 126, 128

Primary name: Hydrobromic acid

Synonym: Hydrogen bromide

CAS RN: 10035106

Formula: HBr

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Detectable as bromide ion, which is in the monitoring program.

Environmental fate: Solubility, greater than 50,000 mg/L. Highly volatile. Forms bromide ion in solution.

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): No

References: 27, 128

Primary name: Hydrochloric acid

Synonym: Hydrogen chloride; Muriatic Acid

CAS RN: 7647010

Formula: HCl

Information sources: Army/Shell

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 18); CAR, Site 1-5 (70, p. 11); CAR, Site 2-8 (76, pp. 13, 16); CAR, Site 26-6 (78, p. 16); CAR, Process Water System (91, p. 21); CAR, Army Spill Sites (125, pp. 9, 24); CAR, North Plants (127, p. 12).

Monitoring history: No information found.

Environmental fate: Discharge to environment would result in chloride ion contribution. Acidity not likely to be persistent. Solubility, 67.3 g/100g H_2O at 30° C.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 1, 10, 27, 31, 37, 42, 52, 66, 70, 76, 78, 91, 125, 127, 128

Primary name: Hydrofluoric acid

Synonym:

CAS RN: 7664393

Formula: HF

Information sources: Army

History of use, production, disposal & quantities: CAR, Section 36 - Nonsource Area (67, p. 11); CAR, Site 36-19 (112, p. 9); CAR, Section 3 - Nonsource Area (113, p. 16); CAR, North Plants (127, pp. 12, 23).

Monitoring history: Fluoride ion detected as a contaminant in ground water north and northwest of Basin A.

Environmental fate: Reacts with sodium hydroxide to form sodium fluoride. Very soluble in water.

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): No

References: 10, 31, 37, 52, 67, 112, 113, 127, 128

Primary name: Hydrogen sulfide

Synonym:

CAS RN: 7783064

Formula: H_2S

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Gas. Vapor pressure, 20 atm at 25.5° C. Solubility, greater than 50,000 mg/L.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 27, 31, 128

Primary name: alpha-Hydroxy-4-(1'-carboxyl-1'-methyl-ethylamino)-6-ethylamino-s-triazine

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No monitoring data.

Environmental fate: No information documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary name: 1-exo-Hydroxychlordene

Synonym: 4,7-Methano-1H-inden-1-ol,4,5,6,7,8,8-hexachloro-3a,4,7,7a-tetrahydro-

CAS RN: 2597117

Formula: $C_{10}H_6Cl_6O$

Information sources: Lessee prior to 1952

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No monitoring data.

Environmental fate: $T_{1/2}$ greater than 5 years.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary name: 4-Hydroxy-3,5-dinitrophenyl methyl sulfone

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No monitoring data.

Environmental fate: No information documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary name: 4-Hydroxy-4-methyl-2-pentanone

Synonym: Diacetone alcohol; 2-Methyl-2-pentanol-4-one

CAS RN: 123422

Formula: $C_6H_{12}O_2$

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring history: Tentatively identified as nontarget analyte in both the RI soil and ground-water programs.

Environmental fate: Solubility at 25° C is 100,000 ppm. Vapor pressure, 1 mm at 20° C.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 41, 59, 128

Primary name: **Hypochlorous acid, calcium salt**

Synonym: **Calcium hypochlorite; Bleaching powder**

CAS RN: 7778543

Formula: $Ca(ClO)_2$

Information sources: **Army**

History of use, production, disposal & quantities: **CAR, Site 1-7 (92, p. 12); CAR, Section 6 - Nonsource Area (115, p. 19); CAR, Site 31-7 (120, p. 12); CAR, Hydrazine Blending and Storage Facility (126, pp. 1-13).**

Monitoring history: **No information found.**

Environmental fate: **In ground water, Hypochlorite ion was observed to disproportionate and produce chlorate ion.**

Toxicity: **Toxicity score, 2 (RTECS).**

Included on target list(s): **No**

References: **10, 92, 115, 120, 126, 128**

Primary name: **Impregnite CC2**

Synonym: Octachlorocarbanilide urea; N, N'-dichloro-N, N'-bis(2,4,6-trichlorophenyl)-

CAS RN: 2899027

Formula: $C_{13}H_4Cl_8N_2O$

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 16)

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 10, 78

Primary name: **Impregnite CC3**

Synonym:

CAS RN: Not available

Formula: Octachlorocarbanilide + Zinc oxide

Information sources Army

History of use, production, disposal & quantities: History of Pollution Sources and Hazards at RMA (10).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 10

Primary name: **Iron (III) oxide**

Synonym: **Ferric oxide**

CAS RN: 1309371

Formula: Fe_2O_3

Information sources: **Army**

History of use, production, disposal & quantities: CAR, Section 20 - Nonsource Area (98, p. 8); CAR, Site 36-16 (111, p. 8).

Monitoring history: **Found in southwest corner of Section 20.**

Environmental fate: **Iron oxide residue poses no threat to ground-water quality as its low solubility controls concentration in aerobic environments.**

Toxicity: **Toxicity score, not rated.**

Included on target list(s): **No**

References: **18, 31, 98, 111**

Primary name: **Isobutylmethacrylate**

Synonym: IM Gel

CAS RN: 97869

Formula: $[(CH_2\text{-}C(CH_3)COCH_2CH(CH_3)_2)]$+ gasoline

Information sources: Army

History of use, production, disposal & quantities: CAR, Section 5 - Nonsource Area (114, p. 15); CAR, Section 8 - Nonsource Area (116, p. 10); CAR, Site 32-6 (122, p. 13).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, 1 (RTECS).

Included on target list(s): No

References: 10, 42, 114, 116, 122, 128

Primary name: **Isodrin**

Synonym: 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexa-hydro-1,4,5,8-endo,endo-dimethanaphthalene; 711

CAS RN: 465736

Formula: $C_{12}H_8Cl_6$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: Limited monitoring data shows Isodrin present in soil, alluvial aquifer and bedrock aquifer.

Environmental fate: $T_{1/2}$ in soil approximately 6 yrs. Non-volatile. Solubility, less than 1 mg/L (estimated). Byproduct in an aerobic environment is endrin. Photodrin is a probable byproduct of photolysis in the environment.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): Ground-Water and Soil

References: 1, 27, 30, 31, 42, 78, 128

Primary name: **Isopropyl methyl phosphonate**

Synonym: IMP

CAS RN: Not available

Formula: $C_4H_{11}O_3P$

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: No information found.

Environmental fate: Water soluble and possibly mobile in ground water.

Toxicity: Toxicity score, 1 (Mecler, 1981).

Included on target list(s): Soil, as isopropylmethyl phosphonic acid.

References: 2, 31, 134

NO ENTRIES

Primary name: Keto-endrin

Synonym: 2,5,7-Metheno-3H-cyclopenta[a]pentalen-3-one,3b,4,5,6,6,6a-hexachlordecahydro-(2-alpha,3a-beta,3b-beta, 4-beta,5-beta,6a-beta,7-alpha,7a-beta,8R*)

CAS RN: 53494705

Formula: $C_{12}H_8Cl_6O$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Keto-endrin distribution is limited to the southwestern region of Section 36.

Environmental fate: $T_{1/2}$ greater than 5 years. Estimated solubility, less than or equal to 1 mg/L.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 9, 27, 128

Primary name: **Landrin**

Synonym: Trimethylphenyl methylcarbamate

CAS RN: 12407862

Formula: $C_{11}H_{15}NO_2$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Hydrolyzes in alkaline solution, $t_{1/2}$ 42 hours; pH 8, $t_{1/2}$ in soil, 60 days. Not mobile in soil.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): No

References: 1, 11, 27, 31, 128

Primary name: **Lead**

Synonym:

CAS RN: 7439921

Formula: Pb

Information sources: Army

History of use, production, disposal & quantities: CAR, Section 20 - Nonsource Area (98, p. 8).

Monitoring history: Included as an analyte in soil and ground-water monitoring programs.

Environmental fate: Included in trace metal analysis of water and plants. Occurs naturally in soil and water and is distributed by vehicular emissions. Attacked by pure water, weak organic acids in presence of oxygen.

Toxicity: Toxicity score, 3 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 23, 31, 37, 54, 56, 98, 128

Primary name: **Lewisite (M-1)**

Synonym: beta-Chlorovinyldichloroarsine; Chlorovinylarsine dichloride

CAS RN: 541253

Formula: $C_2H_2AsCl_3$

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-5 (62, p. 8); CAR, Site 36-17 (66, pp. 7, 48); CAR, South Plants Manufacturing Complex (68, p. 7); CAR, Sites 1-13 and 2-18 (73, p. 8); CAR, Site 31-4 (119, p. 22); CAR, Site 31-7 (120, p. 18); CAR, North Plants (127, p. 17).

Monitoring history: M-1 settle to the bottom of Basin A near the contaminated sewer outlet. High concentrations of M-1 were found in Basin A.

Environmental fate: Rapidly decomposes to Lewisite oxide and further inorganic arsenic forms when exposed to atmospheric moisture. Specific gravity of 1.88. Hydrolysis is rapid for vapor and dissolved Lewisite. Low solubility in H_2O. Unstable in water and moist air.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 30, 31, 52, 62, 66, 68, 73, 119, 120, 127, 128

Primary name: **Lewisite oxide**

Synonym: beta-Chlorovinyldichloroarsine epoxide; Dichloro (2-chlorovinyl) arsine oxide.

CAS RN: 333255

Formula: $C_2H_2AsCl_3O$

Information sources: Army

History of use, production, disposal & quantities: Problem Definition Studies on Potential Environmental Pollutants (2).

Monitoring history: Reported in environmental samples.

Environmental fate: Formed by decomposition of Lewisite exposed to atmospheric moisture.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 2, 31, 128

Primary name: **Lime, chlorinated**

Synonym: Hypochlorous acid, calcium salt

CAS RN: 7778543

Formula: $CaOCl_2H$

Information sources: Army

History of use, production, disposal & quantities: CAR, Section 6 - Nonsource Area (115, p. 19)

Monitoring history: No information found.

Environmental fate: Produces hypochlorite (ClO^-) ion and chloride ion in aqueous solution.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 10, 31, 115, 128

Primary name: **Magnesium**

Synonym:

CAS RN: 7439954

Formula: Mg

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-12 (65, p. 7); CAR, Section 36 - Nonsource Area (67, p. 10); CAR, Site 19-1 (95, p. 8); CAR, Site 29-4 (101, p. 11); CAR, Section 8 - Nonsource Area (116, p. 10), CAR, Site 32-6 (122, pp. 12-13).

Monitoring history: Included in ground-water monitoring program. Small concentrations above ambient at Well 81A, just north of Shell Chemical Company in Section 36, and at three stations in and immediately downgradient from Basin A, Wells 7 (southeast of Basin A perimeter), 40 (within Basin A perimeter), and 65A (northwest of Basin A perimeter).

Environmental fate: Metal powder used in incendiaries would slowly oxidize if discharged to environment. Reacts very slowly with water at ordinary temperatures (less than 100° C).

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): Ground-Water

References: 3, 10, 21, 37, 65, 67, 95, 101, 116, 122, 128

Primary name: **Magnesium hydroxide**

Synonym:

CAS RN: 1309428

Formula: $Mg(OH)_2$

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 9); CAR, Site 2-8 (76, p. 13).

Monitoring history: No information found.

Environmental fate: Compound adds small amount of magnesium to ambient concentration. Practically insoluble in water (1:80,000). Absorbs CO_2 in the presence of water.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 10, 37, 42, 44, 66, 76

Primary name: Malathion

Synonym: 0,0-Dimethyl-s-(1,2-dicarbethoxyethyl) phosphorodithioate

CAS RN: 121755

Formula: $C_{10}H_{19}O_6PS_2$

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 31-4 (119, p. 22).

Monitoring history: Included in ground-water and Basin F fluid analysis. Included in soil monitoring program.

Environmental fate: Solubility, 145 mg/L at 20° C. Vapor pressure 4 x 10^{-5} mm at 20° C.

Toxicity: Tocixity score, 3 (RTECS).

Included on target list(s): Soil

References: 21, 25, 30, 31, 41, 119, 128

Primary name: **Manganese**

Synonym:

CAS RN: 7439965

Formula: Mn

Information sources: Not assigned

History of use, production, disposal & quantities: Found in association with landfill leachate.

Monitoring history: Detected in North Boundary Well #60 and Well #105; Basin F Wells 81A, 40, and 65A; and wells downgradient of Basin A.

Environmental fate: Natural constituent in ground water.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 6, 21, 23, 25, 128

Primary Name: **Mercaptodiacetic acid**

Synonym: 2,2'-Thiodiglycolic acid

CAS RN: 123933

Formula: $C_4H_6O_4S$

Information sources: Army

History of use, production, disposal & quantities: Possible hydrolysis product of mustard.

Monitoring history: No information found.

Environmental fate: During hydrolysis, both of mustards' chlorine atoms are substituted with hydroxyl groups yielding thiodiglycol (infinitely soluble in water), and gaseous hydrogen chloride (very soluble in water). When heated to decomposition thiodiglycolic acid emits toxic fumes of SO_x.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 31, 51

Primary name: **Mercuric chloride**

Synonym: Mercury chloride ($HgCl_2$)

CAS RN: 7487947

Formula: $HgCl_2$

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-17 (66, p. 11); CAR, Sanitary Sewer - South Plants (89, p. 18).

Monitoring history: See monitoring history of mercury and chloride.

Environmental fate: Probably underwent conversion to elemental Hg under typical environmental conditions. Also interaction between $HgCl_2$ and iron piping formed Hg metal. Soluble in H_2O, methanol, acetone, and ethyl acetate. Methyl mercury salts may result from mercuric chloride decomposition. Under anaerobic conditions in sediment, bacteria can methylate or dimethylate Hg^{+2} from $HgCl_2$. Addition of ethyl group to Hg in nature is unknown. Solubility, 1 gram dissolves in 13.5 ml water.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 2, 10, 30, 31, 37, 52, 66, 89, 128

Primary name: Mercury

Synonym:

CAS RN: 7439976

Formula: Hg

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-5 (62, pp. 8-9); CAR, Site 1-11 (72, p. 19); CAR, Sites 1-13 and 2-18 (73, p. 18); CAR, Site 2-8 (76, p. 15); CAR, Section 20 - Nonsource Area (98, p. 8); CAR, North Plants (127, p. 17).

Monitoring history: Found in lime pits and Basin F (reference 10). Also found in soil samples of RMA, specifically Section 36. Large concentration of Hg detected at western edge of Basin A (reference 18). Detected in Basin B.

Environmental fate: Bioaccumulates. Insoluble in H_2O. Heavy, mobile, liquid metal.

Toxicity: Toxicity score, 3 (RTECS).

Included on target list(s): Ground-Water and Soil

References: 6, 10, 18, 23, 25, 31, 35, 37, 62, 72, 73, 76, 98, 127, 128

Primary name: **Methane dichloride**

Synonym: Methylene chloride

CAS RN: 75092

Formula: CH_2Cl_2

Information sources: Shell/Army

History of use, production, disposal & quantities: CAR, North Plants (127, p. 13).

Monitoring history: Included in environmental monitoring program for source definition.

Environmental fate: Vapor pressure, 349 mm at 20° C. Solubility, 20 mg/L at 20° C.

Toxicity: Toxicity score, 2 (RTECS). EPA carcinogenic classification, B2 (probable human carcinogen).

Included on target list(s): Ground-Water and Soil

References: 10, 31, 41, 52, 54, 55, 127, 128

Primary name: **Methanethiol**

Synonym: Methyl mercaptan

CAS RN: 74931

Formula: CH_4S

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Reacts with H_2O, steam, or acids to produce toxic and flammable vapors. Stench producing chemical. Vapor pressure, 2 atm at 26.1° C.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 1, 27, 31, 41, 42, 128

Primary name: **Methanethiol, sodium salt**

Synonym: Methyl mercaptan, sodium salt

CAS RN: 5188078

Formula: CH_4S Na

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 27, 42, 128

Primary Name: **Methomyl**

Synonym: s-Methyl-N-(methylcarbamoyloxy)thioacetimidate; Nudrin insecticide

CAS RN: 16752775

Formula: $C_5H_{10}N_2O_2S$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: No information found.

Environmental fate: Aqueous solubility, 58 g/L. Hydrolysis $t_{1/2}$ 140 hours at pH 7 and 50° C. Hydrolysis rate greater at higher pH.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 1, 10, 11, 27, 31, 42, 78, 128

Primary name: **N-Methylacetoacetamide**

Synonym: Butanamide, N-methyl-3-oxo

CAS RN: 20306756

Formula: $C_5H_9NO_2$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Degraded by microorganisms, $t_{1/2}$ 1 to 6 months. Solubility, greater than 50,000 mg/L.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27, 42

Primary name: **Methyl acetylacetate**

Synonym: Acetoacetic acid, methyl ester

CAS RN: 105453

Formula: $C_5H_8O_3$

Information sources: Shell

History of use, production, disposal & quantites: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Hydrolyzes. Degraded by microorganisms, $t_{1/2}$ less than 6 months. Solubility, greater than 50,000 mg/L.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 1, 12, 27, 42, 128

Primary name: 2-Methylalanine

Synonym: a-Aminoisobutyric acid

CAS RN: 62577

Formula: $C_4H_9NO_2$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: No information found.

Environmental fate: Solublility ranges from 1,000 to 50,000 mg/L. $T_{1/2}$ 6 mo. to 1 yr.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 27

Primary Name: **Methylarsonic acid**

Synonym: Methanearsonic acid

CAS RN: 124583

Formula: $CH_3AsO(OH)_2$

Information source: Not assigned

History of use, production, disposal & quantities: Possible degradation product from Lewisite manufacture.

Monitoring history: Not included in environmental monitoring history.

Environmental fate: Strong dibasic acid, freely soluble and soluble in alcohol. Fate not documented.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 37, 128

Primary Name: **Methylphosphonic acid, disodium salt**

Synonym: **Sodium methyl phosphonate**

CAS RN: 20677218

Formula: $CH_5PO(ONa)_2$

Information sources: **Army**

History of use, production, disposal & quantities: **Disposal of Chemical Wastes, RMA (25).**

Monitoring history: **No information found.**

Environmental fate: **Ultimately degrades to sodium and phosphate.**

Toxicity: **Toxicity score, not rated.**

Included on target list(s): **No**

References: **25, 26**

Primary name: **Methyl phosphonic acid, isopropyl ester**

Synonym:

CAS RN: **Not available**

Formula: **Not available**

Information sources: **Army**

History of use, production, disposal & quantities: **CAR, Site 30-5 (104, p. 7).**

Monitoring history: **Not included in environmental monitoring program.**

Environmental fate: **Fate not documented.**

Toxicity: **Toxicity score, not rated.**

Included on target list(s): **No**

References: **48, 104**

Primary name: 2-Methylbenzyl acetoacetate

Synonym: Acetoacetic acid, methylbenzyl ester; MBAA

CAS RN: 40552849

Formula: $C_{12}H_{14}O_3$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Hydrolyzes. Degraded by microorganisms, $t_{1/2}$ less than 6 months.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27, 42

Primary name: **alpha-Methylbenzyl-2-chloroacetoacetate**

Synonym: **MBCAA**

CAS RN: 68683307

Formula: $C_{12}H_{13}O_3Cl$

Information sources: **Shell**

History of use, production, disposal & quantities: **Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).**

Monitoring history: **Not included in environmental monitoring program.**

Environmental fate: **Hydrolyzes. Degraded by microorganisms, $t_{1/2}$ less than 6 months. Solubility ranges from 1,000 to 50,000 mg/L.**

Toxicity: **Toxicity score, not rated.**

Included on target list(s): **No**

References: **1, 12, 27, 42**

Primary name: **Methyl cyclohexane**

Synonym:

CAS RN: 1331222

Formula: $C_7H_{12}O$

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring history: Tentatively identified as nontarget analyte in RI soil program.

Environmental fate: Colorless liquid. Specific gravity at 18° C is 0.925 (2-methylcyclohexanone). Vapor pressure, 144 mm at 20° C. Solubility, 14.0 mg/L at 20° C.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 41, 128

Primary name: 1-Methyl-1,3-cyclopentadiene

Synonym:

CAS RN: 96399

Formula: C_6H_8

Information sources: Shell

History of use, production, disposal & quantities: Geraghty & Miller, Inc. review of portions of the RMA microfilm database (43).

Monitoring history: Not included in environmental monitoring program. Tentatively identified as nontarget analyte in RI soil program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 43, 128

Primary Name: **Methylethyl ketone**

Synonym: 2-Butanone

CAS RN: 78933

Formula: C_4H_8O

Information sources: Shell

History of use, production, disposal & quantities: Shell's Response to U.S. Interrogatory #15 (44).

Monitoring history: Included in environmental monitoring program for source definition.

Environmental fate: Extremely volatile. Soluble in approximately 4 parts water.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 37, 44, 128

Primary name: **N-Methylformamide**

Synonym:

CAS RN: 123397

Formula: C_2H_5NO

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Slightly soluble. Biodegrades.

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 27, 128

Primary name: **Methylhydrazine**

Synonym: Monomethyl hydrazine; MMH

CAS RN: 60344

Formula: CH_6N_2

Information source: Army

History of use, production, disposal & quantities: CAR, Site 1-7 (92, p. 12).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Soluble in water. Corrosive.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): Soil

References: 31, 41, 43, 92, 128

Primary name: **Methylmercury salts**

Synonym:

CAS RN: Not available

Formula: Not available

Information sources: Not assigned

History of use, production, disposal & quantities: Possible decomposition production from mercuric chloride used in Lewisite manufacture.

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Bacteria can methylate or dimethylate Hg^{+2} from suspected Army precursor $HgCl_2$. Addition of ethyl group to Hg in nature is unknown.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 2, 30, 31, 128

Primary name: **Methyl parathion**

Synonym: o,o-Dimethyl-o-(4-nitrophenyl) ester

CAS RN: 298000

Formula: $C_8H_{10}NO_5PS$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 32-5 (121, p. 11); CAR, Site 32-6 (122, p. 15).

Monitoring history: No information found.

Environmental fate: Stable several days at pH 7 and below. Rapidly hydrolyzed in alkaline solutions. Does not persist in soils. Solubility, 55 to 60 mg/L. Log octanol/water partition coefficient 2.04.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 1, 11, 12, 25, 27, 31, 41, 42, 121, 122, 128

Primary name: **Methylphosphonic acid**

Synonym: **MPA**

CAS RN: 993135

Formula: CH_5O_3P

Information sources: **Army**

History of use, production, disposal & quantities: **Problem Definition Studies on Potential Environmental Pollutants (2).**

Monitoring history: **Found in well on Arsenal property (26).**

Environmental fate: **Toxic to plants. High stability in environment. Water soluble and possibly mobile in ground water.**

Toxicity: **Toxicity score, not rated.**

Included on target list(s): **Soil**

References: **2, 26, 31, 34**

Primary name: **Methylnaphthalene**

Synonym:

CAS RN: 1321944

Formula: $C_{11}H_{10}$

Information sources: Not assigned

History of use, production, disposal & quantities: No information located.

Monitoring history: Tentatively identified as nontarget analyte in RI soil program.

Environmental fate: Natural sources are coal and petroleum. Solubility at 25° C is 26 to 28 mg/L (1-methylnaphthalene).

Toxicity: Toxicity score, 2 (RTECS).

Included on target list(s): No

References: 31, 41, 128

Primary name: **Methyl phosphonic dichloride**

Synonym: Dichlor; Dichloro

CAS RN: 676971

Formula: CH_3POCl_2

Information sources: Army/Shell

History of use, production, disposal & quantities: CAR, North Plants (127, p. 12).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, 1 (RTECs).

Included on target list(s): No

References: 10, 127, 128

Primary name: **Methylthioacetaldoxime**

Synonym: **Acetaldehyde, (methylthio)-oxime**

CAS RN: 10533672

Formula: C_3H_7NOS

Information sources: Shell

History of use, production, disposal & quantities: CAR, Site 26-6 (78, p. 17).

Monitoring history: No information found.

Environmental fate: Hydrolyzes. Adsorbed on clay. Degraded by soil microorganisms, $t_{1/2}$ 1 to 6 months. Highly soluble.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27, 42, 78

Primary name: Mineral oil

Synonym: Kaydol - Paraffin oil

CAS RN: 8012951

Formula: Mixture of liquid hydrocarbons from petroleum.

Information sources: Shell

History of use, production, disposal & quantities: Shell Response to US Interrogatories #14 and #15 (44, 47).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Insoluble in water.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 31, 37, 42, 44, 47

Primary name: **Monomethyl chloroacetoacetamide**

Synonym: **MMCAA; Butanamide, 2-chloro-N-methyl-3-oxo**

CAS RN: 4116103

Formula: $C_5H_8ClNO_2$

Information sources: Shell

History of use, production, disposal & quantities: CAR, Sites 1-13 and 2-18 (73, p. 14); CAR, Site 2-8 (76, p. 13).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27, 73, 76

Primary Name: **Monopropellant hydrazine**

Synonym: MPH

CAS RN: Not available

Formula: Not available

Information sources: Army

History of use, production, disposal, & quantities: CAR, Site 1-7 (92, p. 12); CAR, Hydrazine Blending and Storage Facility (126, p. 1-7).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 43, 92, 126, 128

Primary name: **Monomethyl dichloroacetoacetamide**

Synonym: **MMDCAA**

CAS RN: Not available

Formula: $C_5H_7Cl_2NO_2$

Information sources: Shell

History of use, production, disposal & quantities: Readily Available Data on 169 Compounds Associated with Operations at Rocky Mountain and Pine Bluff Arsenals (27).

Monitoring history: Not included in environmental monitoring program.

Environmental fate: Fate not documented.

Toxicity: Toxicity score, not rated.

Included on target list(s): No

References: 1, 27

Primary Name: **Mustard**

Synonym: B, B'-Dichlorodiethylsulfide; Bis(2-Chloroethyl)sulfide; HD

CAR RN: 505602

Formula: $C_2H_4Cl_2S$

Information sources: Army

History of use, production, disposal & quantities: CAR, Site 36-4 (61, p. 9); CAR, Site 36-5 (62, p. 8); CAR, Site 36-12 (65, p. 7); CAR, Site 36-17 (66, pp. 12, 27, 28, 37, 38); CAR, Section 36 - Nonsource Area (67, p. 11); CAR, South Plants Manufacturing Complex (68, p. 7); CAR, Site 1-3 (69, p. 12); CAR, Sites 1-13 and 2-18 (73, p. 8); CAR, Sanitary Sewer - South Plants (89, pp. 14, 17); CAR, Chemical Sewers - North Plants and South Plants (90, p. 15); CAR, Section 20 - Nonsource Area (98, p. 7); CAR, Site 30-3 (103, p. 8); CAR, Site 30-6 (105, p. 12); CAR, Site 36-14 (110, p. 8); CAR, Section 3 - Nonsource Area (113, p. 16); CAR, Section 6 - Nonsource Area (115, p. 19); CAR, Site 31-4 (119, p. 15); CAR, Site 31-7 (120, p. 15); CAR, North Plants (127, p. 17).

Monitoring history: Surgeon General's soil data detected no mustard gas in any of the samples.

Environmental fate: All spills hydrolyzed to thiodiglycol, although intact mustard has been found in the drain and waste pipes of an inactive building at RMA. Mustard in water decomposes rapidly by hydrolysis. Mustard sprayed on the surface of the soil remains vesicant for only about 2 weeks, decomposing under the influence of natural environmental conditions. Mustard that leaks some depth into soil will remain vesicant at least 3 years after contamination. Mustard in containers is stable for long periods. Deep contamination of soil by mustard may persist for many years.

Toxicity: Toxicity score, 4 (RTECS).

Included on target list(s): No

References: 2, 10, 18, 25, 31, 52, 61, 62, 65, 66, 67, 68, 69, 73, 89, 90, 98, 103, 105, 110, 113, 115, 119, 120, 127, 128